HOSPITAL ACQUIRED PRESSURE ULCERS IN ONCOLOGY UNITS:

RISK, PREVALENCE, AND NURSE VARIABLES

by

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ABSTRACT

Hospitals acquired pressure ulcers (HAPUs), a nationally recognized indicator of hospital and nursing quality, pose a notable risk to hospitalized patients for pain, debility and death. Oncology patients represent a large portion of hospitalized patients. Numerous common cancer symptoms and complications are known risk factors for HAPUs. HAPU prevalence in oncology units is unknown. Previous research has demonstrated that nurse education and practice environments are significantly related to patient outcomes. The relationship between these variables and HAPUs is unknown.

The purpose of this research was to examine the risk for and prevalence of HAPUs on oncology units and evaluate the relationship between them and nursing variables by comparing oncology units to nononcology units. The sample included 145 oncology and 212 nononcology units. Mean unit HAPU prevalence rates for all stage ulcers was not significantly different between unit types (2.9% and 2.6%; $p \geq .05$). Total ulcer rates likewise failed to demonstrate significance (10.9% and 11.2%; $p \geq .05$). Unit mean Braden Scale scores measuring risk for HAPU on admission were different with the oncology unit mean significantly higher, demonstrating less patient risk for breakdown, than nononcology units (19.0 and 18.6; $p \geq .05$). This difference was lost over time, as the unit mean for nononcology units improved between admission and the last recorded to score to 18.9, while the oncology unit mean remained stable at 19.0. No difference was found in mean percent of nurses with a BSN by unit (55.3% and 54.1%). Nurse

practice environment, measured with the Practice Environment Scale of the Nurse Work Index (PES-NWI), failed to demonstrated significant differences on any of the five subscales or the total score ($p \geq .05$) between unit types. A moderated mediation analysis, utilized to evaluate the relationship of the nurse variables to HAPUs, failed to reach significance on either unit type.

The lack of difference by unit type for risk, prevalence, and nursing variables reduces the need to examine oncology units individually from other units. Continued efforts to understand the development of HAPUs needs to incorporate changing rates over time and evolve the relationship to nurse variables.

To Isabelle for being the Sunshine
To My Mom for making me wear a hat and everything else
To Luke for cheering as I ate the elephant, one bite at a time
To My Dad: "Losing love is like a window on your heart;
everybody sees you're broke apart."
Paul Simon

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CHAPTER 1

INTRODUCTION

Statement of the Problem

Individuals with cancer and cancer related diagnoses are a large proportion of hospitalized adult patients. Accounting for 4.7 million discharges in the U.S. in 2009, over 17% of all adult hospitalizations are for cancer or a cancer related problem (Price, Stranges, & Elixhauser, 2012). Oncology patients and oncology units are rarely identified specifically in research of either nursing or hospital quality indicators, including hospital acquired complications. International research has demonstrated that oncology patients are particularly vulnerable to at least one complication of hospitalization: hospital acquired pressure ulcers (HAPUs; Fromantin et al., 2011; Kim, Kim, & Lee, 2010; Maide et al., 2009; Masaki, Riko, Seji, Shuhei, & Aya; 2007). However, little is known about the incidence, prevalence, or risk for HAPUs in oncology settings in this country.

HAPUs are pressure ulcers that develop while a patient is in the hospital. In *Patient Safety: A Handbook for Nurses,* published by the Agency for Healthcare Research and Quality (AHRQ), HAPUs were identified as one of the three most frequent complications of hospitalization effecting almost half a million people annually (Lyder & Ayello, 2008). HAPUs are a progressive complication generally expected to worsen with prolonged stays. The progressive nature of HAPUs suggests that the longer a patient is hospitalized, the longer they are exposed to the conditions that can lead to a pressure ulcer. The average length of stay for patients admitted with cancer as the primary diagnosis is 6.3 days, compared to the overall average of 4.8 days (National Center for Health Statistics, 2013). Cancer as a primary diagnosis has the third longest average length of stay behind psychoses (average length of stay including all classifications is 7.2 days) and septicemia (average length of stay is 8.8 days), a common primary diagnosis for cancer patients. Collectively, these data raise many questions about the risk for HAPUs in cancer patients.

The risk for HAPU development is multifactorial and generally increases as the number of risk factors increase (Alderden, Whitney, Taylor, & Zaratkiewicz, 2011; Bry, Buescher, & Sandrik, 2012; VanDenKerkhof, Friedberg, & Harrison, 2011). Six components, sensory-perception impairment, mobility limitations, moisture exposure, decreased nutrition, and the risk of friction and shear injuries, are the most well documented risk factors for HAPUs (National Pressure Ulcer Advisory Panel-European Pressure Ulcer Advisory Panel [NPUAP-EPUAP], 2009). Additionally, vasopressor infusions, spinal cord injury, advanced age, low body mass index, multiple comorbities, general debility, hypoalbuminia, anemia, and low lymphocyte counts are associated with higher risk and are common conditions of patients with cancer (Alderden et al., 2011; Bry et al., 2012). The combination of increased exposure related to lengthy hospitalizations with the multiple physiological risk factors people with cancer face make the lack of knowledge regarding HAPU prevalence in the U.S. oncology population a significant gap in the literature.

HAPUs are progressive in nature. They are classified by stages, according to the extent of injury; that is an effect of both accumulated risk factors and the passage of time in unknown proportion. HAPUs are largely preventable when available tools for risk identification and reduction are applied. A national, expert consensus conference, convened in 2010 by NPUAP, reaffirmed this conclusion after a detailed review of available evidence (Black et al., 2011). The group emphasized that efforts to avoid skin breakdown cannot be stopped at any time because the progressive nature of ulcers makes minimizing damage and halting progression critical. They stressed the importance of nursing care to avoid and or minimize the development of HAPUs, emphasizing the dual actions of identifying risk and implementing interventions as critical nursing responsibilities.

The AHRQ, the American Nurses' Association (ANA), the National Quality Forum (NQF), and the National Database of Nursing Quality Indictors (NDNQI®) all identify HAPUs as a nursing sensitive indicator of hospital quality (Montalvo, 2007, p. 1). The ANA states that nurse sensitive patient outcomes are "distinct and specific to nursing" and "are most influenced by nursing care" (Montalvo, 2007). The ability of nurses to identify the risk for HAPUs, combined with the existence of numerous evidence-based interventions to reduce the risk, provides a strong basis for the connection between nursing and HAPUs. It is not clearly understood why this fails. Given the available knowledge regarding how pressure ulcers develop, who is at risk for developing them, and what to do to avoid them, the continuing incidence of HAPUs requires further research (Beltz, 2013).

An examination of current research points to two nursing variables that have repeatedly demonstrated a significant link with a variety of patient outcomes: nurse work environment and nurse education (Aiken, Clarke, Cheung, Sloane, & Silber, 2003; Aiken, Clarke, Sloane, Lake, & Cheney, 2008; Aiken, et al., 2011; Bosh et al., 2011; Flynn, Liang, Dickson, & Aiken, 2010; Friese, Estabrooks, Midodzi, Cummings, Ricker, & Giovannetti, 2005; Gajewski, Boyle, Miller, Oberhelman, & Dunton, 2010; Houser, ErkenBrak, Handberry, Ricker, & Stroup, 2012; Johnson, 1988; Kendall-Gallagher, Aiken, Sloane, & Cimiotti, 2011; Lake, Aiken, Silber, & Sochalski, 2008; Lake & Friese, 2006; Patrician, Shang, & Lake, 2010; Tourangeau et al., 2007; Sasichay-Akkadechanunt, Scalzi, & Jawad, 2003). HAPU incidence in various populations has been included as an outcome of this research numerous times with mixed results. None of the published studies specifically included HAPUs in oncology, nor did they examine how nurse education and work environment interact to effect HAPU development.

HAPUs add an average 6 additional days to a hospital stay, increase the likelihood of post-hospital-placement in a long term care facility by 50%, cause increased pain, and increase the risk for infection and mortality (Lyder & Ayello, 2008; Lyder et al., 2012; Russo, Steiner, & Spector, 2008; Sullivan & Schoelles, 2013). The accumulation of physiological risk factors for HAPUs in cancer patients has not been quantified with either incidence or prevalence data in the U.S. The connection between nurses and HAPUs is commonly accepted, but lacking in specific research designed to define the relationship. Nurse-sensitive patient outcomes research suggests that nurse education and work environment have a significant link to patient outcomes in hospitals. Research needs to document HAPU prevalence in oncology patients and describe the relationship between it and nurses in order to improve patient safety.

Purpose and Specific Aims

The purpose of this study was to determine the relationship between HAPUs and nurses on oncology units. The study focused on three aims each with several research questions.

Aim 1: To describe HAPU prevalence rates on oncology specialty units and to compare these rates with overall hospital rates.

- RQ1 What is the risk for skin breakdown as determined by the Braden Scale for patients cared for on oncology specialty units?
- RQ2 What is the prevalence rate for HAPU development on oncology specialty units overall and for each stage of ulcers?
- RQ3 How does the HAPU prevalence rate on oncology specialty units compare with overall hospital rates?

Aim 2: To describe the nurse education and work environment of oncology specialty units and determine if they are different from the overall hospital.

- RQ1 What is the percent of nurses on oncology specialty units with a baccalaureate degree (BSN) or higher as their highest degree in nursing?
- RQ2 How do nurses rate the nurse practice environment of oncology specialty units utilizing the Practice Environment Scale of the Nurse Work Index (PES-NWI)?
- RQ3 How does the average level of nursing education and average PES-NWI score differ between oncology units and the overall hospital scores?

Aim 3: To examine the relationship between patient variables and nurse variables on oncology specialty unit and compare it to relationship for the overall hospital.

- RQ1 What is the relationship between a patient's risk for skin breakdown as measured by the Braden Scale and the development of unit specific HAPU as mediated by the use of the pressure ulcer prevention interventions when moderated by the nurse practice environment and the education level of the RNs on oncology specialty units?
- RQ2 How do the relationships differ from that of the overall hospital?

Review of Literature

Hospital Acquired Pressure Ulcer Development

Skin is the body's primary protective mechanism, against both internal and external forces. Intact skin forms a barrier shielding the body from pathogens, fluid and electrolyte loss, and mechanical and ultraviolet injury. Skin is critical to thermoregulation, excretion, metabolism, communication within the body, and sensation. At rest, over one-third of the circulating blood volume of the body is actually in the skin supporting these many functions. Skin is composed of numerous layers, each with different structure and functions. Collectively, these layers are responsible for protection from water loss and physical damage such as shearing, friction, and toxins. It provides thermal insulation and acts to cushion the underlying structures from mechanical damage. Nerve transmissions originating in tactile sensors in the skin enables recognition of a great many experiences via touch, provides warnings regarding impeding danger via pain, and communicates pleasure. Both acute and chronic pain impulses are transmitted via various fibers in the skin. Skin contributes significantly to temperature regulation and fluid-electrolyte balance through peripheral temperature receptors, sweat glands, and the dilation or constriction of blood vessels. All of these functions rely on intact skin and are generally slowed by the normal aging process.

A basic component of the aging process includes the thinning of the layers of the skin including a loss of adipose tissue. This loss reduces the amount of cushion between the boney prominences and contact surfaces, creating the opportunity for an ulcer to develop. Pressure condensing the skin layers combined with shear forces rubbing the skin layers away leads to damage seen first as red areas progressing to open areas, or ulcers, that grow and deepen over time. These changes are predictable, progressive, and defined by the classification tool developed by NPUAP (Baranoski & Ayello, 2004). The most recent revisions of the staging tool were complete in 2007 and include six stages (Table 1.1). Stages 1–4, plus unstageable and suspected deep tissue injury (NPUAP-EPUAP, 2009).

Stage 3, full thickness skin loss, and Stage 4, full thickness tissue loss, are considered late stage ulcers. Unstageable ulcers are those ulcers that are obscured by slough or eschar, making an assessment of the full depth of the wound impossible. Suspected deep tissue injury ulcers appear as purple or maroon areas either intact or covered by a blood filled blister. Although the time for an ulcer to evolve from Stage 1 to a Stage 4 is not predictable, it is predictable that left alone without changes in the conditions contributing to the ulcer, an ulcer will worsen over time.

The progressive nature of HAPUs provides a clear opportunity for nursing intervention. The basic understanding that unrelieved pressure results in skin breakdown leads directly to the connection that care givers, primarily nurses, could act to relieve pressure, thus avoiding most ulcers. This basic relationship is particularly important for debilitated hospitalized patients like those on oncology units, who often experience numerous risk factors simultaneously.

Assessment of Pressure Ulcer Risk

Identifying patients at risk for skin breakdown is a critical first step for avoiding this condition. The Braden Scale (Appendix) is a widely used tool for assessing the risk of skin breakdown. It incorporates targeted assessments of sensory perception, moisture, activity, mobility, nutrition, and friction-shear. This tool has been available since 1988

Table 1.1. Pressure Ulcer Stages (NPUAP-EPUAP, 2009).

Stage 1 **Nonblanchable erythema**	Intact skin with nonblanchable redness of a localized area usually over a bony prominence. The area may be painful, firm, soft, warmer, or cooler as compared to adjacent tissue.
Stage 2 **Partial thickness**	Partial thickness loss of dermis presenting as a shallow open ulcer with a red pink wound bed, without slough. May also present as an intact or open/ruptured serum-filled or sero-sanginous filled blister. Presents as a shiny or dry shallow ulcer without slough or bruising.
Stage 3 **Full thickness skin loss**	Full thickness tissue loss. Subcutaneous fat may be visible, but bone, tendon, or muscle are *not* exposed. Slough may be present but does not obscure the depth of tissue loss. *May* include undermining and tunneling.
Stage 4 **Full thickness tissue loss**	Full thickness tissue loss with exposed bone, tendon, or muscle. Slough or eschar may be present. Often includes undermining and tunneling.
Unstageable **Full thickness skin or tissue loss – depth unknown**	Full thickness tissue loss in that actual depth of the ulcer is completely obscured by slough (yellow, tan, gray, green, or brown) and/or eschar (tan, brown, or black) in the wound bed.
Suspected deep tissue injury **depth unknown**	Purple or maroon localized area of discolored intact skin or blood filled blister due to damage of underlying soft tissue from pressure and/or ***shear.*** The area may be preceded by tissue that is painful, firm, mushy, boggy, warmer, or cooler as compared to adjacent tissue.

and is recommended by the AHRQ in clinical practice guidelines for the prevention and treatment of pressure ulcers (Institute for Clinical Systems Improvement [ICSI], 2012). The Braden Scale provides descriptions of increasing levels of debility in each of six categories and gives each a number. Users assess patients, choose the descriptor in each section that best matches the patient, and then sum the scores. Patients with total scores of 18 and less are considered at risk for pressure ulcer development. Practice guidelines recommend nurses assess patient risk on admission and every 24 hours during the hospitalization (NPUAP-EPUAP, 2009).

The Braden Scale is recommended for risk assessment for all adult hospital patients (ICSI, 2010). Original testing of the Braden Scale included use by registered nurses, licensed practical nurses, and nurse aides. Interrater reliability was highest ($r = .99$), sensitivity at 100% and specificity between 64% and 100%, when tested with registered nurses using a cut off score of 16 (Bergstrom, Braden, Laguzza, & Holman, 1987). Testing with samples of intensive care patients demonstrated sensitivity at 83% and specificity at 64% (Bergstrom, Demuth, & Braden, 1987). Testing in nursing home patients resulted in similar results: sensitivity of 79% and a specificity of 74% (Braden & Bergstrom, 1994). Further testing demonstrated a score of 18 is the “critical cut off score at most times in most places” (Bergstrom, Braden, Kemp, Champagne, & Ruby, 1998, p. 268). More recent testing across all hospitalized patients, examined the six subscales and demonstrated each to be highly predictive of HAPU development $p < 0.01$ for each (Fisher, Wells, & Harrison, 2004). In a sample of intensive care patients, the overall score was highly predictive of pressure ulcer development ($p \leq .0001$, $C = 0.71$; Tescher, Branda, Byrne, & Naessens, 2012).

Risk for Hospital Acquired Pressure Ulcers in Oncology Patients

Although the Braden scale is highly useful in providing a consistent method to identify, categorize, measure, and discuss risk, it is not exhaustive of all contributing factors. Nutritional issues, such as obesity, cachexia, low body mass index, decreased prealbumin, and hypoalbumnia are noted to have a significant relationship to HAPU development (Alderden et al., 2011). Longer hospitalizations, use of vasopressors, spinal cord injury, and use of mechanical devices are also associated with risk (Alderden et al., 2011). The diagnoses of cancer, congestive heart failure, chronic obstructive pulmonary disease, stroke, and diabetes have all been statistically correlated to HAPU development (Lyder et al., 2012). In addition, hypoalbumin and decreased prealbumin, low lymphocyte, low hemoglobin, and uncontrolled blood glucose are commonly present in patients with very low Braden Scale scores (Bry et al., 2012). Multiple comorbities and high severity of illness are also highly correlated with HAPU development (Alderden et al., 2011; Bry et al., 2012), suggesting a cumulative effect of numerous individual risk factors peaking during hospitalization. All of these conditions are common among the oncology population who are generally hospitalized with greater frequency and for longer periods of time as the illness advances.

International research has demonstrated a higher incidence of pressure ulcers in people with cancer than without (Kim, Kim, & Lee, 2010; Maide et al., 2008; Masaki, Riko, Seji, Shuhei, & Aya, 2007). A 2007 study in a single medical center in Japan retrospectively examined all HAPUs over 2 years and identified that 48% were in patients with cancer and that the cancer patients were at greater risk for skin breakdown ($p = 0.04$) than the general hospitalized population (Masaki et al., 2007). In a similar study of patients in a Toronto hospital referred for palliative care, 53% of patients with cancer developed a pressure ulcer during the end stage of life and had a significantly greater risk for pressure ulcer development then those without cancer (Maida et al., 2008). The same researchers examined only the cancer patients and determined that the presence of pressure ulcers of any stage was highly associated with earlier death (hazard ratio 1.85, 95% confidence interval 1.44 – 2.37, $p < 0.0001$) although no patients died directly from any wounds (Maida, Ennis, Kuziemsky, & Corban, 2009). These results echo early research that prospectively examined risk factors for skin breakdown in hospitalized patients and identified that 85% of patients with cancer developed pressure ulcers, whereas only 70% of the noncancer patients developed an ulcer (Waltman, Bergstrom, Armstrong, Norvell, & Braden, 1991).

No further data regarding people with cancer and pressure ulcer risk or incidence are specifically available for patients in the United States. Two international abstracts on HAPUs in oncology were presented at that 17th Biennial Congress of the World Council of Enterostomal Therapists in Slovenia in 2010. At the National Cancer Center (hospital) in Korea, a retrospective chart audit was completed on patients who had a pressure ulcer in 2006. An overall HAPU incidence rate was determined to be 1.8% with 73% being hospital acquired (Kim et al., 2010). In the second abstract, researchers presented work done in Japan that sought to “clarify risk factors for pressure ulcers in patients receiving palliative care for cancer” (Shibazaki & Tokunaga, 2010, p. 39). In a sample of only 80 patients, the incidence rate for HAPUs was 28.5%, with the rate increasing as patients grew closer to death.

The most recent and largest examination of HAPUs in oncology was a 2009 follow up to a French study originally conducted in 2002, designed to validate the use of a pressure ulcer risk scale specific to oncology patients (Fromantin et al., 2011). In the earlier research, the Norton Scale for risk assessment, the most commonly utilized pressure ulcer assessment tool in France at the time, was compared to the newly developed Curie Scale for assessing skin breakdown risk in adult cancer patients. A total of 351 patients were included in the sample, and a 5% prevalence rate for all stage HAPUs was established. The two scales demonstrated a high level of concordance ($r = -.83$, $p < 0.001$), and the subscales of mobility, incontinence, and moisture/shearing were identified as the key risk factors in oncology patients. The Curie Scale was then modified and renamed the Pressure Ulcer Scale in Oncology (PUSO) and retested in 2009. The same design was utilized, but the Braden Scale replaced the Norton Scale as the control since it had become the more frequently used tool with greater validity (Fromantin et al., 2011). The prevalence rate remained stable at 5%, and the PUSO was strongly correlated with pressure ulcer prevalence ($p < 0.00001$). This evidence of a stable rate of HAPUs in oncology patients over time establishes a baseline prevalence rate for comparison to American oncology patients. It is important to note that this research, as well as several of the other international studies, was conducted in hospitals exclusively treating cancer patients. Although there are oncology exclusive hospitals in the United States, 85% of cancer patients nationally are cared for in general hospitals (National Cancer Institute, 2010).

The most comprehensive examination of HAPU incidence levels in the U.S. to date was a retrospective secondary analysis of Medicare patients hospitalized for any reason between 2006 and 2007. This work calculated a 4.5% overall incidence rate for the development of at least one new pressure ulcer during hospitalization (Lyder et al., 2012). This suggests possible concordance in rates between the U.S. general hospital population and hospitalized oncology patients in France. None of this work has included information about the nurses or environments of care. Understanding both the prevalence of HAPUs in oncology units and the link to nurse factors that might contribute to HAPU prevention could lead to significant new insights for improving outcomes for hospitalized oncology patients.

Interventions to Reduce Hospital Acquired Pressure Ulcers

Assessing patient risk for a HAPU and intervening to reduce the risk in order to avoid a HAPU are accepted components of nursing practice (Beltz, 2013). According to the nursing process, nurses assess and then intervene. When a Braden Scale risk assessment is completed, a score of 18 or less indicates the patient is at risk for a HAPU. For patients at risk, key interventions are recommended to reduce the risk of ulcer development: daily skin assessments, pressure redistribution surfaces, routine repositioning, nutritional support, and moisture management (NPUAP-EPUAP, 2009; ICSI, 2012; Institute for Healthcare Improvement [IHI], 2011). These interventions are matched to the physiologic process of skin breakdown and are the five components identified in the evidence based clinical guidelines for preventing pressure ulcers (NPUAP-EPUAP, 2009).

The simplest but most important aspect of pressure ulcer development is pressure. Pressure on weakened tissues leads to breakdown. The most direct route to avoid a pressure ulcer is to relieve pressure. Body tissues are more tolerant of pressure when dealing with high pressure for lower amounts of time rather than lower pressure for longer duration (Springle & Sonenblum, 2011). This rule points to two critical interventions: repositioning and pressure redistribution by managing contact surfaces like beds and wheelchairs. A recent meta-analysis of physiologic evidence confirmed that standard hospital mattresses offer little assistance for pressure redistribution, but many products are available that are successful at reducing point pressure and decreasing ulcer risk (Springle & Soneblum, 2011). The same analysis reports that although there is scant evidence to confirm or refute the standard 2 hour turn/reposition schedule most often used in hospitals, there is "decades of evidence" supporting the need to reposition (Springle & Soneblum, 2011, p. 207). Further, authors conclude that the ideal time frame for repositioning is dependent on a combination of the pressure to be shifted and the surface being used, suggesting a link back to assessment skills to optimize patient outcomes.

Recommendations for daily skin assessments, controlling moisture, and nutritional support are based more on indirect evidence and expert opinion than the first two interventions (NPUAP-EPUAP, 2009). Daily skin inspections contribute to identifying ulcers early to allow for increased intervention and management. Excessive moisture destroys the outer lipid layer of skin leading to maceration, and excessively dry skin eventually becomes cracked, likewise resulting in open areas. Malnourishment and insufficient fluid, protein, or calories all increase the risk for skin breakdown due to decreased muscle mass, fluid imbalances, and shifts in blood flow to the skin (IHI, 2011). Interventions to reduce the risk for each of these components are most effective when implemented early and consistently. The link between assessing the risk and intervening accordingly is critical to HAPU reduction.

The dual steps of assessment and intervention are equally important to avoid HAPUs. Both are primary nursing responsibilities. Both require a body of knowledge and access to resources. Both are most successful when applied consistently throughout a hospital stay. The ongoing nature of the risk for a HAPU means that any individual nurse can be critical to reduce HAPU development by identifying risk and initiating interventions, and every nurse shares responsibility. This interdependence between patient risk and intervention and between individual and collective nurses demonstrates the complexity of understanding HAPU development and highlights the need to explore how nurses' knowledge and practice environments impact HAPU development.

HAPU as a Quality Indicator

Since the earliest writings about nursing care, pressure ulcers have been identified as an indication of poor care (Nightingale, 1859). HAPUs have been discussed as an indicator of hospital quality since at least 1989 with growing emphasis in recent years. (Baranoski & Ayello, 2004; VanDenKerkhof et al., 2011). The Centers for Medicare and Medicaid Services (CMS) stopped payment to hospitals for late stage pressure ulcers (Stage 3 and 4) in 2008 after identifying them as preventable never events (Niederhauser et al., 2012). Consumer literature repeatedly warns of the danger of developing pressure ulcers during hospitalization, consistently referring to them as the mark of poor quality care (Consumer Reports, 2012; Cooney, 2008). HAPUs, unlike many adverse events, are a visible sign of unsuccessful care that patients and families directly experience consistently until it is healed.

Medicare data from 2006 demonstrated HAPU development were significantly associated with higher in-hospital mortality and 30-day postdischarge mortality (odds ratio (OR) 2.81, 95% confidence interval (CI) 2.44 – 3.23; OR 1.69, 95% CI = 1.61 – 1.77, respectively (Lyder et al., 2012). The same analysis determined that patients with HAPUs were more likely than those without an ulcer to be readmitted within 30-days (OR 1.33, 95% CI 1.23 – 1.45) and had longer lengths of stay by 5 to 6 days. This connection establishes HAPUs as an early warning sign of the overall care provided in a hospital. The close association between nursing and HAPU development makes understanding each of them as a nurse sensitive outcome critical to general hospital quality improvement.

Nurse sensitive patient outcomes research about HAPUs started appearing in the literature in the 1990s. Two meta-analyses, one evaluating the impact of nurse staffing with a variety of patient outcomes and one that exclusively examined studies investigating nurse staffing and HAPUs, summarized these efforts. Both concluded that numerous methodological problems including a wide variety of terms, methods, and the lack of unifying theory have minimized the usability of the data as a whole (Kane et al., 2007; Lake & Cheung, 2006).

Lake and Cheung's meta-analysis (2006) assessed the state of research on HAPUs, as a single patient outcome, in connection to nurse staffing. The work included seven peer reviewed studies, all set in acute care, and all employing multivariate analysis. They reported that of all the analysis, about half of them demonstrated a measure of significance within their individual designs, but there were so many differences in the way staffing was defined and measured that no definitive conclusions could be drawn. The challenges were exacerbated by the mixed use of collection methods for pressure ulcers, with most researchers utilizing administrative data, although with different diagnostic codes, some using chart reviews and at least one using observed prevalence data. The inclusion of Stage I ulcers and present on admission information was also variable in these studies. Due to the wide variety of variables, methods, and results, authors concluded that the data linking nurse staffing to pressure ulcers were "equivocal" (Lake & Cheung, 2006, p. 654). They recommended the use of observational prevalence studies, attention to where and when the ulcer started, individual patient risk factors, and the inclusion of Stage I ulcers in future work. They also point out the lack of a theoretical base as a possible explanation for the mixed methods and inconclusive data.

The conclusions of Lake and Cheung were echoed in a systematic review designed "to analyze associations between hospital nurse staffing and patient outcomes" (Kane et al., 2007, p. 10). Ninety-four different studies were included in the analysis. In broad terms, staffing ratios demonstrated an inverse correlation with patient outcomes, most notably mortality. When the study results were pooled and weighted by sample size, an increase in 1 RN FTE per patient day demonstrated a reduction in mortality of 1.24% ($p < 0.5$), and an increase in one patient per RN per shift was associated with a 0.1% decrease in mortality ($p < 0.005$). Results demonstrated greater significance when staffing was defined as total hours per patient day. The overall hospital death rate was reduced by 1.98% for every additional nurse hour per patient overall ($p < .0005$). This difference highlights the same challenges from the research with HAPUs and staffing; inconsistent use of variables, methods, and lack of theory are potentially contributing to mixed results and resulting in limited usability for improvement efforts.

The same review (Kane et al., 2007) included an examination of the effect of staffing ratios on patient outcomes other than mortality. Although some individual studies reported significant results, no consistent relationship was identified between staff ratios and incidence rates across any of the identified nonmortality outcomes: nosocomial infections, falls, pressure ulcers, pulmonary failure, cardiac failure, and thromboembolic events. Authors repeatedly draw attention to the variability of data collection methods, unclear definitions for core terms, the wide variability of outcomes measures, and lack of a unifying theory to explain results. Ultimately, the report concluded that the data are insufficient to explain or define the relationship between nurse staffing and any of the patient outcomes. Authors noted evidence suggesting a link between nurse education and several aspects of the nurse work environment with a variety of outcomes across several studies and suggested further development of these concepts. Notably lacking in these studies is any mention of oncology units as a specialty population. When data were identified by unit, medical-surgical and intensive care units were utilized, but most often these data were aggregated at the hospital level.

The importance of HAPUs as a hospital measure of quality is reinforced by the continuing efforts to establish a relationship between nurse staffing and HAPU incidence. Four subsequent studies have been published focusing on this presumed link (Burnes-Bolton et al., 2007; Dunton et al., 2007; Mark & Harless, 2010; Van den Heede et al., 2009). Consistent with the earlier work, these studies demonstrated numerous methodical differences in the sources of data, the outcomes examined, and the definitions of staffing variables. Only one study (Dunton et al., 2007) demonstrated any significant relationships between staffing and HAPUs or any of the patient outcomes examined. A significant connection between HAPUs and nurse staffing was identified by utilizing a series of regression trees to identify that variables, from a list of over 20, were most highly related

(Dunton et al., 2007). These indicators were then tested using mixed linear models. HAPU incidence rates were 4.4% higher for every increase of 1 hour of total nursing hours per patient day. At the same time, incidence rates were 0.7% lower for every percentage point increase in RN hours as part of the total hours per patient day. Again, these results demonstrate the complexity of various measures of staffing and create barriers to utilizing the evidence to improve patient outcomes. The other three studies failed to identify significant relationships between variables, and each identified a need to broaden the understanding of staffing by exploring the work environment as a possible variable influencing the nurse-patient relationship (Burnes-Bolton et al., 2007; Mark & Harless, 2010; Van den Heede et al., 2009).

Nurse Work Environment

The discussion of nurse work environment expands the previous focus on nurse staffing to include factors that surround and impact the staffing plan (Aiken et al., 2008). Among the tools to measure nurse work environment available today, the Practice Environment Scale of the Nurse Work Index (PES-NWI) administered by NDNQI® and endorsed by NQF, is the most widely used and validated tool (Aiken et al., 2008; Gajewski et al., 2010; Lake & Friese, 2007; Patrician et al., 2010). The tool is designed to capture the construct of the work group, in hospitals those nurses on the same unit, and measure the collective perspective of the team working most closely together. The tool surveys nurses' perspectives on the overall work environment and along five subscales: physician-nurse relationships, nurse manager-leader support, staffing and resource adequacy, quality foundations of practice, and participation in organizational decisions.

As with the bulk of the research regarding staffing, two measures of mortality, 30-

day postdischarge mortality and in-hospital death due to an avoidable complication known as failure to rescue, are the most common patient outcomes in the literature about nurse work environment. Two large studies both published in 2008, both working with 30-day mortality and failure to rescue as endpoints, utilized the PES-NWI as a nurse variable (Table 1.2; Aiken et al., 2008; Friese et al., 2008). Researchers in both studies examined nurse education, staffing, and work environment individually and collectively in relation to surgical patients; one specifically examined surgical oncology patients. Using similar methods, these studies simultaneously concluded that the three structural factors of nurse staffing, education, and work environment each contribute to surgical patient mortality both during and after the hospitalization.

Aiken et al. (2008) focused on analyzing the net effect of nurse practice environments on patient outcomes after controlling for nurse staffing and nurse education. Friese et al. (2008) utilized the same data set and procedures, but limited the sample to surgical oncology patients. Using PES-NWI results, researchers, excluded two subscales that overlapped with staffing and nurse education, calculated scores at the hospital level for the three remaining subscales, calculated state wide medians on each, and classified each hospital for how they compared to the state median in three categories: better than, poorer than, or mixed. Using these classifications and controlling for patient and hospital characteristics, nurse environment demonstrated a significant relationship to both mortality measures in both studies.

Subsequently researchers expanded this methodology to surgical patients across four states (Aiken et al., 2011). Results were consistent with each of the three nurse factors (staffing, work environment, and nurse education), demonstrating a significant

Table 1.2. PES-NWI and Mortality.

Investigators	Design	Sample	Primary Finding of Relevance
Aiken, Clarke, Sloane, Lake, & Cheney, 2008	Cross-sectional retrospective; controlled for hospital, patient, and nurse characteristics	168 hospitals in Pennsylvania, over 200,000 surgical discharges and nurse survey data from over 40,000 nurses matched by hospital	30-day mortality: 14% lower in positive work environments compared to poor ones OR = .91 and 95% CI (.85, .97) when tested alone and stable at 14% lower when tested in relationship to education and staffing OR = .93 and 95% CI (.87, .99)
Friese, Lake, Aiken, Silber, & Sochalski, 2008	Retrospective, cross-sectional; controlled for hospital, patient, and nurse characteristics	Surgical cancer patients (>25,000) from Pennsylvania hospitals	Unfavorable nurse practice environments was a significant predictor of 30-day mortality OR 1.37, $p < .05$, 95% CI (1.07, 1.76) Unfavorable nurse practice environment was a significant predictor of failure to rescue OR 1.48, $p < .05$, 95% CI (1.07, 2.03)

effect on the same patient mortality outcomes ($p < .001$ for each). Adjusted modeling, which estimated the effect of the three factors together, demonstrated that poor staffing combined with poor work environment increases the odds of death by 3% (OR 1.029; 95% CI 1.010; 1.048; $p < .003$). Researchers concluded that "the significant interaction between nurse staffing and the work environment implies that the effect of nurse staffing is conditional upon the work environment and, alternatively, that the effect of the work environment is conditional on nurse staffing" (Aiken et al., 2011, p. 1050). Further modeling demonstrated that staffing adjustments in hospitals with poor work environments did not result in fewer patient deaths. The same staffing adjustments in hospitals with good work environments reduced the odds of 30-day mortality and failure to rescue by almost 12% and 14%, respectively. This is the only published effort to date to model the way these variables interact with each other. It provides important evidence that staffing alone is not the key predictor of patient outcomes. Staffing is a component of the overall work environment and one with limited independent effect. This evidence provides a direction for future work to explore the way nurse work environment influences other patient outcomes.

Four studies have examined aspects of the nurse work environment and HAPUs (Bosch et al., 2011; Choi, Bergquist-Beringer, & Staggs, 2013; Flynn et al., 2010; Houser et al., 2012). The first translated the hospital-based work on nurse sensitive outcomes by matching nurse survey results on the PEW-NWI to publicly available data regarding nursing home quality found in the Nursing Home Compare database (Flynn et al., 2010). This study, conducted in nursing homes in a single state, is the only one to use the PES-NWI in relation to HAPUs. The PES-NWI total score and four of five subscale scores were significantly and inversely related to the percentage of residents with pressure ulcers. It is important to note that pressure ulcers, including stage I, were recorded without regard to where the patient was when it first developed, and the denominator was derived from all at-risk patients in the facility, a category within the database. These differences are notable when translating between the acute hospital and long term care environments because they reinforce the importance of measuring patient risk while supporting the overall relationship between work conditions and outcomes. The strength of the primary relationship in this study is a critical link. It echoes the hospital results linking work environment and patient mortality, suggesting stability of the construct across different types of nurse environments and different types of patient outcomes. Researchers in Colorado (Houser et al., 2012) examined one dimension of work environment, level of involvement with decision making, in relation to nurse satisfaction, patient satisfaction, adverse events, and infections in hospitals. The study utilized a predecessor to the PES-NWI, the Stamps Work Environment Scale, to measure nurse perceived level of involvement with decision making. Pressure ulcers, as one of three adverse events, were lower in units with high perceived levels of involvement ($f = 3.869$, $p < .05$), high perceived accountability for efficacy of decisions ($f = 3.4$, $p < .05$), and high involvement in outcomes evaluation ($f = 4.5$, $p < .05$). Even with the differences in design, these data lend support to the link between nurse work environments and HAPUs. This link between nurse work environments and outcomes offers a plausible explanation for why HAPUs continue to occur in stable numbers despite the availability of the knowledge to eliminate them.

The third study examining this link likewise did not use the PES-NWI, but two tools, the Competing Values Framework (CVF) and the Team Climate Inventory (TCI), were evaluated in relation to HAPU incidence across the Netherlands in 2005 (Bosch et al., 2011). In this work, data from a national, annual, standardized point prevalence study on HAPUs were matched with survey data. Nosocomial ulcers stage 2 and greater in at-risk patients were included as a measure of quality. The surveys were distributed to one doctor and four nurses per ward, two wards per hospital across the country, including long term care units. The CVF results categorize the culture into one of four types and the TCI graded team work from high to low. These constructs focus on the organizational culture and sense of team work inclusive of interdisciplinary participants. These concepts are radically different from the PES-NWI. No significant relationships were identified with any subset of these surveys with HAPU prevalence. Given the radical differences in the evaluation of work environment, it is difficult to integrate the results. It is, however, possible that the inclusion of more than just nurses coupled with the limits on how many nurses were surveyed per unit interfered with a valid representation of the work environment.

Results from the latest study to examine nurse work environment and HAPUs provide support for the importance of measuring patient outcomes at the level of the hospital unit. When the relationship between nurse workgroup satisfaction and HAPUs was examined in acute care hospitals across the United States using the Job Enjoyment Scale, results were again significant (Choi, Bergquist-Beringer, & Staggs, 2013). A significant and inverse relationship was found for all hospital units combined (OR 0.98, $p < 0.001$) and in three of the unit types: critical care (OR 0.97, $p < 0.001$), medical (OR 0.98, $p < 0.001$), and rehabilitation (OR 0.97, $p < 0.05$). Step-down, surgical, and medical-surgical units did not demonstrate significant relationships. Oncology units were not identified as a unique unit type. Although the Job Enjoyment Scale measures nurse's perspective on their work environment differently than the PES-NWI, results support the link between nurse work environment and patient outcomes and reinforces the importance of nurses as a unique group.

Nurse work environment is a variable measured at the group level of either the entire hospital or the unit. Hospitalized patients encounter nurses in groups, most closely defined as those nurses working on a specific unit. The differences noted in results between data at the hospital level and at the unit level are important. These differences highlight the variability of both patients and nurses within a hospital. Patient aggregation by unit is typically defined by similar conditions likely to require similar resources. The PES-NWI is a measure of the common experience of the unit nurses. The repeated significance of the link between nurse work environment and HAPUs increases the need to explore oncology units as a distinct entity. Nurse work environment is the first unit-specific nurse characteristic to repeatedly demonstrate a significant link with several patient outcomes including HAPUs. Nurse education level is the second.

Nurse Education

Nurses can be prepared with a diploma in nursing, an associate's degree (AD), a baccalaureate degree in nursing (BSN), or even master's degrees (MSN) as an entry into practice. The most recent workforce survey of RNs by the Health Resources and Services Administration (U.S. Department of Health and Human Services, 2010) was completed in 2008. It reported that 39% of newly graduated nurses held a BSN, but the AD remained the most commonly held degree in nursing at 45.4% of all licensed nurses. In 2008, hospitals employed 62.2% of all working nurses, an increase from 57% in 2004. Of nurses with an AD as their highest degree, 64.8% work in hospitals.

The effect of varying levels of education in nursing on the quality of nursing care has been debated for decades. Numerous research studies exploring these differences were conducted in the 1970s and 80s. A meta-analysis of 139 studies comparing BSN, AD, and diploma nurses concluded that BSN graduates were better able to problem solve, teach patients, and communicate professionally and possessed a greater knowledge base than other graduates but were weaker at performing general nursing skills (Johnson, 1988). These data did not make a notable change in either the way nurses are educated or in role definition after graduation.

Early in this decade, researchers began to revisit nursing education as a variable that may influence hospital quality. NQF assessed nurse education as a potential measure of hospital quality (2006). At the time, the assumption that more nurse education improves patient outcomes was generally supported by the available data, but numerous gaps in the evidence and a noted lack of rigor in the evidence led NQF to reject nursing education as a quality measure. NQF recommended continued research into the effect of nurse education on patient outcomes. An emphasis on this connection was echoed by the Institute of Medicine in "The Report on the Future of Nursing" (2010). It included a recommendation that by 2020, 80% of all RNs should be prepared at the BSN level. This recommendation has placed the connection between nurse education and patient outcomes directly in the path of policy makers nationwide.

Corresponding with this increased attention, Painter and Dudjak (2010) report that malpractice cases against RNs that result in payment are increasing. Between 2004 and 2006, data from the National Practitioner Data Bank demonstrated a doubling, from 1 in 100 to 2 in 100, malpractice cases against RNs ultimately being paid. In their analysis of paid claims in a single state involving nurses in acute care, all of the patient outcomes were considered preventable, and 89% of named nurses held preparation less than a BSN. Despite the very small sample size, these early data provide a second avenue of support to the link between nurse education and patient outcomes and increases the scrutiny of law makers and payers.

Outcomes research has explored the link between nurse education and patient mortality (Table 1.3) almost as often as it explored nurse staffing. Of the seven studies published since 2003, six demonstrated nurse education as a predictor of patient mortality. The most widely known of these studies was conducted by Aiken, Clarke, Cheung, Sloane, and Silber in 2003. Those researchers examined the impact of nurse education on the same two mortality measures discussed earlier, failure to rescue and 30-

Table 1.3. Relationships Between Nurse Education and Mortality.

Investigators	Design	Sample	Primary Finding of Relevance
Aiken, Clarke, Cheung, Sloane, & Silber, 2003	Cross-sectional retrospective; controlled for hospital, patient, nurse	168 hospitals in Pennsylvania; over 200,000 surgical patients	10% increase in BSNs = 5% reduction in both mortality and failure to rescue: odds ratio, 0.95; 95% confidence interval, 0.91–0.99 for both
Estabrooks, Midodzi, Cummings, Ricker, & Giovannetti, 2005	Cross-sectional, retrospective; controlled for hospital and patient	All hospitals in Alberta, Canada, 49; +18,000 medical patients	Proportion of BSN nurses was a significant predictor of 30-day mortality. Odds ratio 0.81; 95% confidence interval 0.68, 0.96. Skill mix, greater percent RNs to other providers, made significant reductions in 30-day mortality; odds ratio 0.83, 95% confidence interval 0.73, 0.96
Tourangeau et al., 2007	Cross-sectional, retrospective; controlled for patient	75 hospitals, Ontario, Canada; +46,000 medical patients; 4,000 nurse surveys	Proportion of BSN nurses was a significant predictor of 30-day mortality. Regression coefficient = -0.01 Standard error = 0.05, T = -1.94, p = 0.057
Aiken, Clarke, Sloane, Lake, & Cheney, 2008	Cross-sectional retrospective; controlled for hospital, patient, and nurse	168 hospitals in Pennsylvania, over 200,000 surgical discharges and nurse survey data from over 40,000 nurses matched by hospital	10% increase in BSNs = 4% reduction in both mortality and failure to rescue: odds ratio 30-day mortality = 0.94; 95% confidence interval, 0.90–0.97 odds ratio failure to rescue = 0.93; confidence interval, 0.89–.97
Friese, Lake, Aiken, Silber, & Sochalski, 2008	Retrospective, cross-sectional; controlled for hospital, patient, and nurse	Surgical cancer patients (>25,000) from Pennsylvania hospitals	Greater proportion of BSN nurses had lower mortality rates p <.05 Greater proportion of BSN nurses had lower failure to rescue p <.01
Kendall-Gallagher, Aiken, Sloane, & Cimiotti, 2011	Secondary analysis; risk adjusted; controlled for state, hospital, patient, and nursing	652 nonfederal hospitals in the United States; over 1 million surgical discharges; merged nurse surveys, hospital surveys, and discharge data	Multiple statistical models demonstrated significant effect of the percentage of BSN and higher nurses on 30-day mortality and failure to rescue, bivariate logistic regression p < .001. Every 10% increase in percentage of BSN nurses is associated with a 6% decrease in the odds of dying.
Sasichay-Akkadechanun, Scalzi, Jawad, 2003	Cross-sectional retrospective; Controlled for patient	One hospital, +2,500 surgical patients	No significant relationship between the proportion of BSNs and in hospital mortality

day mortality, among surgical patients across the state of Pennsylvania, aggregated at the hospital level. After adjusting for patient and hospital characteristics, a 10% increase in the proportion of baccalaureate prepared nurses providing direct patient care was associated with a 5% decrease in both measures (odds ratio, 0.95; 95% confidence interval, 0.91–0.99 for both). A 20% increase in the percentage of BSNs in direct care roles in a surgical unit was calculated to have roughly the same reduction in mortality as a reduction of two patients per nurse.

In 2005, Estabrooks, Midodzi, Cummings, Ricker, and Giovannetti performed a similar analysis on the discharge data of over 18,000 medical patients. Patient age, sex, and comorbidities together were determined to account for 44.22% of the variability in 30-day mortality rates. After adjusting for this effect, 11 nursing variables were examined for significance to mortality. Only four, nurse education level, staff skill mix, nurse-physician relationships, and employment status, were statistically significant, collectively accounting for 36.93% of the variance in 30-day mortality (Nurse education odds ratio, 0.81; 95% confidence interval 0.68, 0.96; skill mix odds ratio 0.83, 95% confidence interval 0.73, 0.96). Although not identified by the collective term of nurse work environment, staff skill mix and nurse-physician relationships are components of the PES-NWI.

The proportion of BSN nurses was also identified as one of several factors shown to have a significant effect on 30-day mortality rates for acute medical patients (regression coefficient = -0.10, t = -1.94, p = 0.057) in Ontario, Canada (Tourangeau et al., 2007). Of the 16 nurse-related characteristics examined, only five were found to be independent predictors of 30-day mortality: proportion of RNs in the skill mix, proportion of nurses with BSN degrees, nurse-reported adequacy of staffing, higher use of care maps, and higher nurse-reported quality of care. Collectively these variables explained 50% of the variance. Of note, nurse-reported staffing adequacy and quality are two of the five subscales of the PES-NWI.

Two studies from 2008 (Aiken et al., 2008; Friese et al., 2008) reinforced both the findings regarding nurse educational level and components of the PES-NWI. Both studies examined nurse education as the percent of staff with a BSN or higher. In the analysis of all surgical patients (Aiken et al., 2008), nurse education was found to be independently related to both mortality measures (30-day mortality OR 0.94, 95% CI 0.90-0.97; $p < 0.01$ and failure to rescue OR 0.93, 95% CI 0.89-0.97; $p < 0.01$). Significance was repeated in the surgical oncology subset (Friese, Lake, Aiken, Silber & Sochalski, 2008) with 30-day mortality ($p < 0.05$) only. Both conclude that improving nurse education, staffing, and work environments will result in fewer deaths among surgical patients. Both studies stop short of describing how the factors are linked or maybe influencing each other. Neither study offers a model or theory to frame or explain the results, generally viewing all three variables as structural components influencing the outcome.

Subsequently, Kendall-Gallagher, Aiken, Sloane, and Cimiotti (2011) conducted a secondary analysis of surgical discharges from four states. Repeating similar techniques, they tested the effect of nursing education, measured by the percent of all hospital nurses with a BSN and higher, on both mortality measures, failure to rescue, and death within 30-days of discharge, by matching nurse surveys, hospital surveys, and discharge data. In this study, both unadjusted and adjusted effects for each variable were examined. Odds ratios associated with BSN and higher education level, in an unadjusted model, demonstrated significance ($p < .001$) for both outcomes. In the adjusted models, designed to test the net effects of nurse education, experience, and certification, only education demonstrated a significant effect, which was seen on both outcomes ($p < .001$).

In contrast to these results, the percentage of RNs with a BSN was one of three independent variables (years of experience, nursing degree, and proportion of RNs to total nursing staff) explored in relation to mortality in Thailand (Sasichay-Akkadechanunt et al., 2003) that did not demonstrate significance. The fourth variable, nurse-to-patient ratio, was a significant predictor of mortality in a cross section of medical and surgical patients both when correlated with patient characteristics and with the three other staffing variables ($\beta = -1.234$, $p < .01$, and $\beta = -.613$, $p < .01$, respectively). It is critical to note that 96% of the nursing sample had BSNs, thus all but eliminating variability.

The available data examining nurse education and patient outcomes are challenged on a number of fronts. Of note, this work has been conducted exclusively utilizing mortality measures as outcomes. Additionally, the formula used to determine how many nurses qualified in each educational category changed across studies. These limitations pose significant challenges to the conclusion that simply increasing the percentage of BSN nurses on a unit or in a hospital will result in improved patient outcomes. Finally, no models are proposed to explain how or why nurse education influences patient outcomes. Despite these limitations, the consistency of the results across samples and definitions cannot be ignored.

The measurement of the average number of BSN nurses on a unit used in several studies provides an opportunity to replicate the method and expand analysis to other patient outcomes. Parallels in the relationships between mortality measures and HAPUs are demonstrated in the literature examining nurse staffing and PES-NWI. The general pattern of these data supports the idea that nurse variables may interact in similar ways to influence a variety of patient outcomes. This link reinforces the need to test the relationship of nurse education and other patient outcomes, such as HAPUs. The body of work on nurse education also provides reinforcement for the relationship of nurse work environment to patient outcomes as numerous studies included various subscales of the PES-NWI.

Summary of Literature

HAPUs are a significant source of morbidly, mortality, suffering, and cost for patients in U.S. hospitals. The list of risk factors for developing a HAPU is extensive and includes the diagnosis of cancer as well as many common cancer-related problems like cachexia and anemia. No data exist to document the prevalence of HAPUs in oncology units in the United States. This gap leaves oncology patients at a potential disadvantage as the lack of specific data defining the problem may divert attention away from HAPU recognition and reduction efforts on oncology units.

At the hospital level, HAPUs are a national quality indicator. Assessing and intervening are independent responsibilities of nurses. The Braden Scale to assess risk for HAPUs and practice guidelines detailing interventions to reduce risk make HAPUs largely avoidable and align directly with nurses. A large body of nurse-sensitive patient outcomes research has established a link between nurse work environment and nurse education and patient outcomes. Patient outcomes are better when the nurse work environment is positive and educational levels are higher. New research needs to explore how these variables are related to patient outcomes and to each other. New models need to capture the simultaneous nature of nurse work environment and education level on patient outcomes. This study sought to address the gap in knowledge about HAPUs on oncology units and the need to test models explaining how nurses affect patient outcomes by describing HAPU prevalence and testing a moderated mediation model.

Theoretical Framework

Nurse sensitive patient outcomes research has been suffering from a lack of a unified theoretical framework (Mark & Harless, 2010; Mark, Hughes, & Jones, 2004). The primary theoretical model has been Donabedian's broad structure-process-outcomes model (Mitchell et al., 1998; Mitchell & Lange, 2004; Swan & Boruch, 2004). This model provides a general perspective on the connections of any system, but it lacks specificity to the nurse patient relationship. Additionally, it is typically operationalized as a linear model, suggesting that structural characteristics directly lead to processes that then result in outcomes (Donabedian, 1992). Neither the nurse nor patient is specifically identified in the model. The simplicity of the model is attractive for running standard statistical tests, but may contribute to the inconsistent results of many parallel studies. The linear relationship between structure, process and outcomes limits the complexity of human interactions within the system, limits inclusion of multiple factors occurring simultaneously, and does not account for how the three subsections influence each other in real time.

One effort to expand the structure-process-outcomes model and respond to these gaps was the Quality Health Outcomes Model (QHOM)(Mitchell et al., 1998). This model addressed both the linearity of the structure-process-outcome model and the absence of the patient and nurse in the model. The model proposes a multidirectional process where the client and system interact both with each other directly as well as through interventions and outcomes (Figure 1.1).

The multidirectionality of this model demonstrates feedback loops where aspects of the system and client are directly and indirectly changing each other, as well as simultaneously impacting the interventions and outcomes. This presents a more complex picture then Donabedian's model and more closely represents the interconnectedness of these components in practice.

Use of the QHOM to frame research questions has been minimal since its proposal (Mitchell & Lange, 2004). A search of MEDLINE and CINAHL for QHOM returned only unpublished dissertations. One possible explanation for the lack of use may be the complex interconnectedness of the model. The model is essentially circular, which means that any point could be considered the beginning and almost any variable could be conceptualized as the independent variable. The circular nature of the model makes the application of common statistical tests difficult. The model, although conceptually an

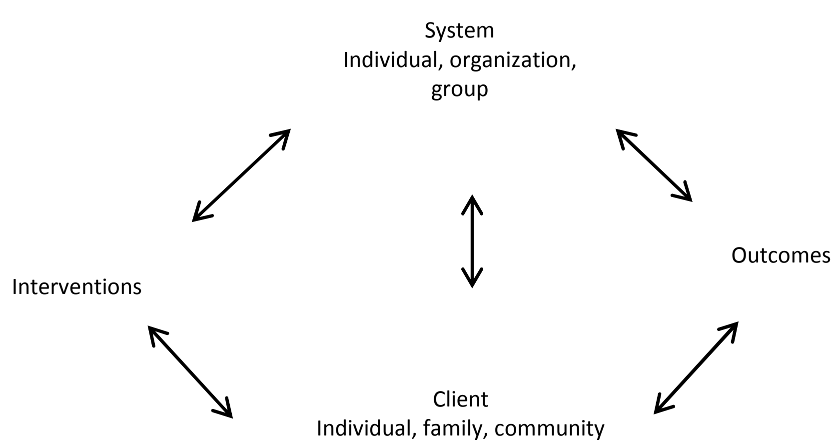

Figure 1.1. Quality Health Outcomes Model.

improvement over the structure-process-outcomes model, lacks functionality.

Both models suffer from a lack of unifying theory, which has left research efforts somewhat disjointed (Mark et al., 2004; Mitchell et al., 1998). The absence of a unifying theory to explain and predict the nurse patient relationship leaves research in this area fragmented. The lack of a "micro-level theory of how nurses create quality of care" leaves many questions regarding how to design tests (Mark & Harless, 2009, p. 45). Neither model offers any explanation of how or why specific variables are connected or influence each other, resulting in fragmented results, which are difficult to interpret or apply (Mark et al., 2004). Until there is a unifying theory, research must continue to test different models reflecting the most up-to-date evidence on the relationship between nurses and patient outcomes.

At the most basic, the relationship between patient and nurse can be viewed through the application of the nursing process. The nursing process is the collective and ongoing application of assessment, intervention, and evaluation by the nurse to and for the patient. The nursing process includes actionable steps in the form of interventions. Interventions are taken based on the nurse's assessment of the patient. The ability of a nurse to choose and implement any intervention is entirely based on their knowledge. But the ability to actually complete the action of the intervention could be impacted by numerous factors in the environment of care. It is possible that these links are reflected in the current body of knowledge regarding nurse sensitive patient outcomes such as HAPUs. The nursing process itself could be the core of a research model for nurse sensitive patient outcomes that incorporates current evidence about the significance of nurse work environments and nurse education (Figure 1.2).

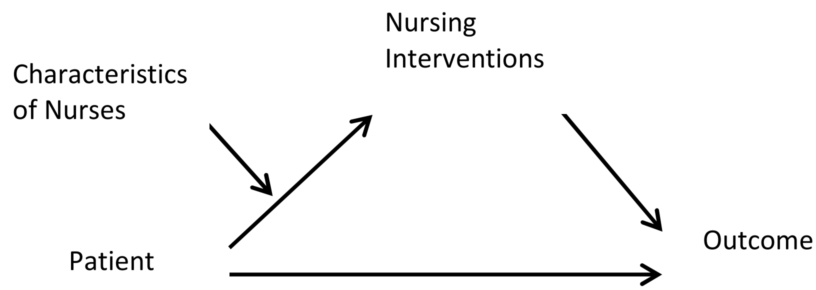

Figure 1.2. Nursing Process Model.

This study proposed and tested a moderated-mediation model of nurse sensitive patient outcomes where the core relationship was between the patient and their outcome. The relationship was mediated by the application of nursing care in the form of nursing interventions and moderated by characteristics of the nurse.

Mediators (M) are variables that explain the mechanism of action between independent and dependent variables. Importantly, they are defined by their causal relationship between the independent (X) and dependent (Y) variables. Mediation reflects a three variable system whereby X occurs before M, which occurs before Y. A mediator variable “causes variation in the dependent variable and itself is caused to vary by the independent variable” (MacKinnon, 2008, p. 8). In the Nursing Process Model, nursing interventions occur after the patient is assessed and are intended to change the likelihood of an outcome, thus mediating between patient and outcome.

Moderators are variables that affect the direction or magnitude of a relationship (MacKinnon, 2008). The relation of X and Y change at different levels of a moderator variable. Moderators are typically measured before an intervention as they “provide information on when effects are present” (MacKinnon, 2008, p. 11). In the Nursing

Process Model, nurse work environment and education are not in the casual pathway between a patient and their outcome. They exist simultaneous to the patient and affect the use of interventions, thus moderating the pathway between patient and intervention.

Moderated-mediation provides an explanation for both how and when a given effect occurs. It “occurs when the strength of an indirect effect depends on the level of some variable, or in other words, when mediated relations are contingent of the level of a moderator” (Preacher, Rucker, & Hayes, 2007, p. 193). The Nursing Process Model proposes that the relationship between a patient and their outcome is mediated by the application of nursing interventions and moderated by the nurse variables of work environment and education.

In this research, the outcome of interest is HAPUs (Figure 1.3). Patients who are at risk for skin breakdown can be identified by nursing assessment on admission. Once a patient is determined to be at risk (a score of 18 or less on the Braden Scale), the level of risk is evaluated on a continuum (lower scores indicate greater risk). The risk score, the independent variable, has been demonstrated to be predictive of the development of a

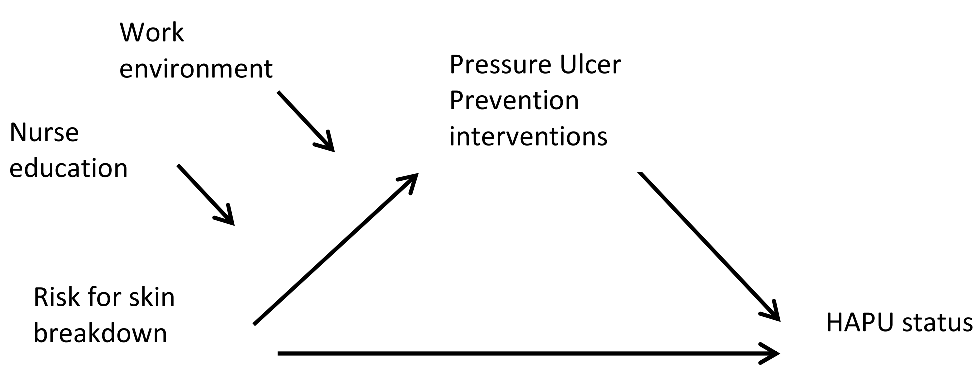

Figure 1.3: Research model

HAPU, the dependent variable. HAPUs are likewise measured on a continuum reflected in the classification of ulcers by stage. Not all patients at risk develop HAPUs nor does the risk score directly predict HAPU stage. This relationship is potentially interrupted by the use of nursing interventions designed to reduce risk. The interventions are acting to mediate the core relationship. In theory, all patients at risk will receive equal intervention and avoid pressure ulcer development while hospitalized. The model builds on current knowledge by proposing both a mechanism of action and an explanation of variance based on previously published research. It proposes the theory of nursing process itself as the underlying framework of nurse sensitive patient outcomes. This model proposes to include all patients at risk in the sample, not only those who develop a HAPU. Historically patient outcomes research starts from the end, evaluating only the sample of patients who did experience a negative outcome. But this minimizes the opportunity to learn about what leads to positive patient outcomes. Building on the very basic connection that the development of a HAPU is a failure of nursing, at-risk patients who do not develop ulcers are potentially indicators of successful nursing. This model provides an opportunity to examine positive and negative patient outcomes on a continuum that could lead to actionable strategies at the unit or hospital level to benefit patients.

Research Design

A retrospective, descriptive analysis of secondary and deidentified data from the National Database of Nursing Quality Indicators (NDNQI®) was conducted. All data were used with permission from NDNQI®. The American Nurses Association established NDNQI® as a longitudinal database to support research regarding the link between nurses and patient outcomes (Dunton et al., 2007). HAPU, risk for developing a HAPU, and prevention efforts to avoid HAPUs have been included in the database from the beginning (Dunton et al., 2007). As of December 2012, over 1,800 hospitals belong to NDNQI® from all 50 states and the District of Columbia (NDNQI®, 2012). Of them, over 1,600 report clinical data and almost 900 take part in the PES-NWI survey (NDNQI®, 2012). In 2009, over 3,300 adult care units from 561 different hospitals reported both pressure ulcer and nurse staffing data, with at least a 50% response rate (Choi, Bergquist-Beringer, & Staggs, 2013). Over 88% of units reported pressure ulcer data using the Braden Scale (NDNQI®, 2012). NDNQI® asks all participating hospitals to identify their units by type. Two different options are available for oncology specialty units: adult medical oncology or adult medical-surgical oncology. To qualify for these designations, 80% of admissions must be for an oncology diagnosis. Units identifying themselves as adult medical oncology or adult medical-surgical oncology were first compared for differences and then merged together as oncology units and compared to the results from other specialty units.

Sample and Setting

In order to examine differences between oncology patients and other populations, unit designation was used as a proxy measure. NDNQI® protocols dictate that at least 80% of a unit's admissions have a diagnosis aligned with the specialty unit title. Specialty unit options are medical oncology, medical surgical oncology, neurology, infectious disease, gastrointestinal, respiratory, cardiac, renal, neuro/neurosurgery, and med-surg cardiac. Medical oncology and medical surgical oncology units were examined separately and then together as oncology units. All other specialty types were combined as nononcology units for a comparison point. All units with a specialty designation, with complete pressure ulcer data, who reported using the Braden Scale, and who completed PES-NWI in 2012 were included in the data analysis. Skin data collected in the same quarter the hospital completed the annual PES-NWI were utilized for the moderated mediation analysis.

Measures

Patient Outcomes Data

NDNQI® skin data are collected by participating hospitals via a quarterly prevalence study. Each hospital chooses one day a quarter to collect data. On this day, NDNQI® trained hospital staff members visually assess each in patient, on each unit of the hospital. They complete a head to toe skin assessment, documenting any areas of breakdown. Then chart reviews are completed to gather the following data: the condition of the patient's skin on admission, the daily skin assessment if recorded, any interventions implemented for skin care, and patient demographics. Skin breakdown is classified according to the NPUAP staging guidelines (Table 1.1). All data are collected without personal identifying information and are transmitted to NDNQI® via secure network connections.

This research utilized the Braden Scale score on admission and last recorded score, all reported interventions, and the count of total, hospital acquired and unit acquired ulcers at all stages.

Skin Data Validity

Member hospitals that choose to collect skin data are required to follow a strict protocol. The protocol includes a process to ensure that only trained nurses collect the required data. The appointed nurses must complete the web-based training, which ensures consistency in all steps of the process. The NDNQI® process for skin data collection was tested for interrater reliability in 2005. Over 250 individuals representing 48 member hospitals trained to do data collection took part in reliability testing of the process. The ability to identify pressure ulcers verses nonpressure ulcers for all participants demonstrated high reliability ($k = 0.84$, $SD = 0.25$), and participants demonstrated moderate agreement ($k = 0.65$, $SD = 0.21$) at staging pressure ulcers (Hart, Berquist, Gajewski, & Dunton, 2006).

Nurse Education

Data for nurse education and nurse work environment are collected as part of the annual PES-NWI survey. Member hospitals may choose to conduct an annual workforce survey of registered nurses using the PES-NWI. The survey is conducted electronically via secure network. Hospitals must utilize the NDNQI® protocol for recruitment and advertisement and are encouraged to support participation. All RNs and advanced practice nurses working: (a) at least part time, (b) with at least 50% of their time spent in direct patient care in an enrolled unit for at least 3 months prior to the actual survey, are eligible to participate. Hospitals mail invitation letters to eligible nurses' homes, which includes information to access the survey online. Access codes are specific to the hospital, not the individual. Surveys are confidential; no personal identifying information is collected. Participating nurses identify themselves by the unit they work on, and hospitals have no access to specific individual answers. Hospitals may monitor only the number of participants by unit during the survey. The survey is conducted for 3 weeks at intervals designated by NDNQI®. Data are collated at the hospital and unit level. Only units with at least five participants and 50% of the eligible staff were received from NDNQI®. The mean unit score for the PES-NWI overall and each subscale were used. The data include demographic information collected from the respondents and collated to the unit level.

Practice Environment Scale of the Nursing Work Index

The PES-NWI was developed to capture the perceptions of nurses regarding the unit environment. Central to the use of the tool is the idea that nurses working together in small units develop common perceptions regarding key components of their work life (Gajewski et al., 2010). The current tool is the culmination of several iterations, tested repeatedly according to "best practice psychometric methods" (Gajewski et al., 2010, p. 148). The most recent effort to test tool validity was a multilevel confirmatory factor analysis analyzing the five domains of the tool. The factor analysis demonstrated factorial, convergent, discriminant, and criterion related validity at both the unit and individual RN level (Gajewski et al., 2010).

Human Subjects Protection

A waiver was received from the Institutional Review Board (IRB) at the University of Utah for this proposal. This study involved the use of completely deidentified data and posed no risk to subjects. Original data collection was approved by the University of Kansas IRB. Data are the property of NDNQI® as a division of the

ANA. Permission for use was granted by the ANA.

Procedures

Patient and nurse data were received from NDNQI® in three files: ulcer data, demographics, and nurse survey. Ulcer data were listed by patient and were first merged to the unit level. Ulcer data were then matched by unit to the demographic and survey data. Units using the Braden Scale for HAPU risk assessment were identified, and all those using any other type of assessment were eliminated from the sample. Hospital characteristics of teaching status, magnet status, ownership, and bed size were requested for use as control variables. Ownership was not included in the data from NDNQI® as its inclusion would have risked the loss of participant confidentiality.

Data Analysis

Descriptive statistics were used to examine all research questions in Aim 1, to describe HAPU risk and prevalence rates and Aim 2, and to describe the nurse variables of education and practice environment. For both aims, descriptive analysis of unit level measures was conducted (frequencies, mean, and standard deviations) for each identified unit type. All comparisons were completed using independent sample *t* tests. Moderated mediation testing was completed by use of the MODMED macro (Hayes, 2007) for SPSS. All analysis was completed via SPSS version 22. Statistical significance was set at $p \leq 05$.

Significance of the Study

The development of a HAPU causes pain, increased hospitalization, and increased risk of mortality. At its most basic, long periods of immobility, typically experienced in relation to hospitalization, put patients at risk for skin breakdown. Oncology patients are hospitalized for longer periods of time than the average patient and experience many physiological changes associated with HAPU development. This study is the first to describe HAPU risk and prevalence in oncology patients in the U.S. Similarly, this is the first research to describe the ratio of nurses with a BSN and the nurse practice environment on oncology specialty units. These nurse variables have previously demonstrated significant relationships to numerous patient outcomes. As a significant driver of hospital admissions, understanding the unique needs and experiences of patients with cancer is important both to directly improve cancer care but also general hospital quality.

The focus of this study at the unit level is part of the growing effort to bring the investigation of patient outcomes and safety measures closer to the point of care (Choi & Boyle, 2014). Hospital level data can now be broken down to the unit level to improve the match between patients and the nurses who care for them. Unit level differences need to be explored for both patient and nurse variables to continue to fine tune the use of quality indicators and guide practice changes to improve patient care. Specific data will lead to more successful improvement strategies for nurse sensitive patient outcomes and support the ability to discern when to customize care and when to utilize common interventions. This study adds important information about unit and population based differences for oncology patients and nurses.

Finally, this research explored the application of a new model to explain how nurses influence patient outcomes. Models of nurse sensitive outcomes research are generally lacking (Mark & Harless, 2010) leaving research in this field disjointed. The relationship between nurses and patient outcomes lacks an explanation of how the variables influence one another. The knowledge that there is a relationship between specific nurse variables and specific patient outcomes will not result in large scale improvement strategies until the mechanism of relationship is defined. The proposal and testing of numerous models is needed to refine the knowledge of the nurse-patient relationship and truly explain how nurses add value to patient care. This research is one such effort.

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CHAPTER 2

RISK FOR HOSPITAL ACQUIRED PRESSURE ULCERS IN ONOCOLOGY DESIGNATED UNITS: A DESCRIPTIVE STUDY OF NDNQI® DATA

Abstract

Hospital acquired pressure ulcers (HAPU) are known as an adverse hospital event. Hospitalized cancer patients commonly experience numerous risk factors for skin breakdown. International studies have identified oncology patients to be at higher risk for HAPUs than the general hospital population, but prevalence rates in U.S. oncology units is unknown. Patient risk for developing a HAPU is commonly evaluated using the Braden Scale, with lower scores indicating greater risk. The scale provides a standard measure of the risk for HAPUs among hospitalized patients, which can be utilized to evaluate population risk across hospitals.

The purpose of this study was to describe the risk for HAPUs on oncology designated units and compare it to nononcology units. A descriptive, cross-sectional analysis of secondary data from the National Database of Nursing Quality Indicators (NDNQI®) was completed. The sample included 6,803 patients from 358 oncology and nononcology specialty units in the second quarter of 2012. On admission to the hospital, mean unit Braden Scale scores in both oncology and nononcology units were above the at

risk score of 18. The oncology unit mean score, 18.98, was significantly higher ($p \geq .05$) on admission than the nononcology score, 18.59. The mean Braden Scale scores on oncology units did not change over time. However, a significant improvement was noted on nononcology units between the admission score and last recorded scores, 18.59 and 18.81 ($p \geq .05$). Regardless of unit, only 64% of patients who developed a HAPU were considered at risk on admission and only 7.3% of at risk patients developed a HAPU.

These results point to factors beyond the Braden Scale influencing HAPU development and the need for more studies regarding specific risk factors for ulcer development. In practice, these data encourage nurses to utilize the Braden Scale as the beginning point for evaluating a patient's risk for a pressure ulcer, but not an exhaustive explanation.

Background

Pressure ulcers, localized injury to the skin and or underlying tissues, are typically found over bony prominences as the result of direct pressure or pressure in combination with shearing (National Pressure Ulcer Advisory Panel-European Pressure Ulcer Advisory Panel [NPUAP-EPUAP], 2009). Long term illness that results in extended periods of immobility is the primary risk factor for ulcer development. Pressure ulcers are a source of pain (Lyder et al., 2012; Pieper, Langemo, & Cuddigan, 2009), increase the likelihood of nursing home placement (Russo, Steiner, & Spector, 2008), and are a direct cause of an estimated 60,000 deaths per year (The Joint Commission, 2011). Patients who are repeatedly hospitalized due to advancing and complex illness are at increased risk for skin breakdown when compared to the general hospital population (Tescher, Branda, Byrne, & Naessens, 2012).

Hospital acquired pressure ulcers (HAPUs), ulcers that develop during hospitalization, have been identified as one of the three most frequent complications of hospitalization (Lyder & Ayello, 2008). Pressure ulcers have been publicized in lay media as a mark of poor hospital care (Consumer Reports, 2012; Cooney, 2008). Late stage ulcers were named to the first list of hospital acquired conditions for that the Centers for Medicare and Medicaid Services (CMS) would not reimburse any associated costs of care (CMS, 2005). Unlike many other adverse events, HAPUs are progressive and generally worsen over time. The longer a patient is exposed to risk factors such as immobility, particularly during hospitalization, the greater the risk for ulcer development and progression.

In 2012, cancer and cancer related diagnoses accounted for 17% of all adult hospitalizations in the United States (Price, Stranges, & Elixhauser, 2012). Patients with a cancer diagnosis average a hospital stay almost 2 days longer than the general patient population (6.3 days versus 4.8 days; National Center for Health Statistics, 2013). The total number of people with a cancer diagnosis in hospitals, coupled with the extended length of stay of these patients, is strong reason to examine the specific risk for HAPUs in hospitalized cancer patients.

Sensory-perception impairment, moisture exposure, decreased nutrition, and the risk of friction and shear injuries are the most well documented risk factors for HAPUs. Vasopressor infusions, spinal cord injury, multiple comorbidities, and general debility are likewise associated with higher risk (Alderden, Whitney, Taylor, & Zaratkiewicz, 2011; Bry, Buesher, & Sandrick, 2012). Additionally, specific nutritional issues, including cachexia, low body mass index, decreased prealbumin and hypoalbumnia, are noted to have a significant link to HAPU development (Alderden et al., 2011). Low lymphocyte, low hemoglobin, and uncontrolled blood glucose are also commonly present in patients at very high risk for breakdown (Bry et al., 2012). These risk factors tend to accumulate in patients with advanced illness and are commonly experienced cancer complications (Alderden et al., 2011; Bry et al., 2012).

The possibility that cancer patients are at greater risk from HAPUs than the general hospital population is supported by data. Early HAPU research in the United States demonstrated that 85% of hospitalized cancer patients developed an ulcer compared to only 70% of all nononcology patients (Waltman, Bergstrom, Armstrong, Norvell, & Braden, 1991). A study from Japan reported that 48% of all HAPUs in the medical center occurred in cancer patients (Masaki et al., 2007). Research from a Canadian inpatient palliative care unit reported that 53% of patients with cancer developed a pressure ulcer during the end stage of life, and the presence of a pressure ulcer was highly associated with earlier death (hazard ratio 1.85, 95% confidence interval 1.44–2.37, $p < 0.0001$; Maida et al., 2009). At the Korean National Cancer Center, overall prevalence for pressure ulcers was only 1.8% over a 20-month retrospective study, but 73% of the ulcers were HAPUs (Kim, Kim, & Lee, 2010). The international evidence of the link between cancer and HAPUs raises questions about the unique risk to these patients.

Risk for skin breakdown is most commonly assessed with the Braden Scale. This tool has been available since 1988 and is a widely accepted method to quantify risk for pressure ulcers in hospitalized patients (Alderman et al., 2011; Baranoski & Ayello, 2004; Bosch et al., 2011). It is recommended by the Agency for Healthcare Research and

Quality (AHRQ) in clinical practice guidelines for the prevention and treatment of pressure ulcers (Institute for Clinical Systems Improvement [ICSI], 2012). The tool incorporates the six most well documented risk factors for skin breakdown: sensory perception, moisture, activity, mobility, nutrition, and friction-shear, with descriptions of increasing levels of debility in each. Each description is matched to a number allowing users to convert narrative descriptions into an overall score. Patients with total scores of 18 or less are considered at risk for pressure ulcer development (Bergstrom, Braden, Laguzza, & Holman, 1987; Bergstrom, Demuth, & Braden, 1987). Nurses are generally encouraged to assess patient risk on admission and every 24 hours during the hospitalization (NPUAP-EPUAP, 2009).

Validity testing of the Braden Scale has been repeated in numerous patient samples and with a variety of staff. Interrater reliability was highest ($r = .99$), sensitivity at 100% and specificity between 64% and 100%, when tested with registered nurses and nursing home and medical surgical patients (Bergstrom, Braden, Laguzza, & Holman, 1987). RNs using the tool to assess intensive care patients demonstrated sensitivity at 83% and specificity at 64% (Bergstrom, Demuth, & Braden, 1987). Further testing demonstrated a critical cut-off score of 18 was the best predictor of pressure ulcer development ($p = 0.0001$) across the most types of patients in the widest variety of settings, including tertiary care, skilled nursing facilities, and Veterans' Medical Centers (Bergstrom, Braden, Kemp, Champagne, & Ruby, 1998). Testing specifically in intensive care units determined the overall score with 18 as the cutoff point was highly predictive of pressure ulcer development ($p \leq .0001$, C = 0.71; Tescher et al., 2012).

Although generally recommended for all hospitalized patients, the Braden Scale has not been specifically tested in oncology patients (Fromantin et al., 2011). Given the list of factors beyond those assessed in the Braden Scale commonly found among oncology patients, there is reason to question if it is specific enough to identify risk. French researchers designed and tested the Pressure Ulcer Scale in Oncology (PUSO) in two steps (Fromantin et al., 2011). Originally, an earlier version of the PUSO was compared to the Norton Scale for risk assessment, the most commonly utilized pressure ulcer risk assessment tool in France at the time, and demonstrated a high level of concordance ($r = -0.83$, $p < 0.001$). This version of the PUSO, known as the Curie Scale, included six categories. When examined closely, three components: mobility, continence, and moisture/shearing, demonstrated unique predictive value among hospitalized oncology patients. These items were the only three included in the PUSO, tested in a follow up study in 2009. The three dimension PUSO was tested in 2009 against the Braden Scale, which had become the most frequently used tool in France (Fromantin et al., 2011). The PUSO strongly correlated with pressure ulcer prevalence ($p < 0.00001$) and strongly correlated with the Braden Scale (Spearman's rho = -.83, $p<.001$). Across both studies, a 5% prevalence rate for all stage ulcers in oncology patients remained stable between 2002 and 2009. This current study provides support for the use of the Braden Scale with oncology patients, although the scale may have more items than necessary. The study authors noted that only 1% of patients with a Braden score ≤ 18, considered at risk, actually developed a pressure ulcer, but 22% of patients with a Braden score >18 developed an ulcer. Although not discussed in the article, this finding raises questions about cancer specific risk factors for HAPU not captured in either the Braden Scale or the PUSO and highlights the need for greater understanding of this risk. The aim of this research was to measure the risk for HAPUs on oncology units in the United States and compare it to the risk on nononcology units.

Methods

A descriptive, cross-sectional analysis was conducted utilizing data collected by the National Database of Nursing Quality Indictors (NDNQI®). NDNQI® is database operated by the American Nurses' Association to collect a variety of nursing sensitive variables in an effort to further nursing research (Dunton, Gajewski, Klaus, & Pierson, 2007). Pressure ulcer data are one of the oldest and most commonly reported patient outcomes in the database. The pressure ulcer module includes measures of risk for skin breakdown as recorded by the nurses in the patient record at two time points. The first is within 24 hours of admission to the hospital and the second is the last recorded score in the patient record at the time of data collection. The time between these two points is not captured.

Pressure ulcer data are collected at the level of the individual patient but do not include patient diagnosis. Patients can be aggregated by unit allowing for a proxy measure of diagnosis by unit specialty. NDNQI® recognizes numerous unit specialties; medical oncology, medical surgical oncology, neurology, infectious disease, gastrointestinal, respiratory, cardiac, renal, neuro/neurosurgery, and med-surg cardiac. A hospital can choose to identify a unit by one of these specialties if 80% of the patients admitted to the unit have a matched diagnosis. For the purpose of this research, only units reporting a specialty designation were included in the sample if they reported pressure ulcer data in the second quarter of 2012 and completed an annual nurse survey in 2012 and who used the Braden Scale.

NDNQI® members who choose to report pressure ulcer data must follow a rigorous protocol including standardized education for the nurses collecting the data as well as detailed instructions for collecting and reporting the data. All skin data are collected on one day across the organization. Every available patient is assessed directly by the data collection nurses, and every chart is reviewed. This process has demonstrated reliability in repeated tests (Hart, Berguist, Gajewski, & Dunton, 2006). All pressure ulcers are recorded, and nursing documentation is used to determine when the ulcer started. This allows ulcers to be categorized as present on admission, hospital acquired or unit acquired. For this study, HAPUs of any stage and the Braden Scale scores at both time points where used to examine the risk for skin breakdown in patients on oncology units and then to compare the risk to patients on nononcology units. Independent samples *t*-tests were conducted to compare group means.

Results

A total of 358 units from 196 hospitals were included in the sample, representing 6,803 patients. The sample included 86 medical oncology units with 1,481 patients and 59 medical surgical oncology units with 973 patients. There were 213 nononcology specialty units with a total of 4,349 patients. Across the entire sample, 97.7% of the last recorded Braden Scale score had been completed in the 24 hours prior to data collection. Comparison of medical oncology to medical surgical oncology units for patient age, gender, hospital size, teaching status, Magnet status, Braden Scale score on admission, and last Braden Scale score recorded identified no significant differences between groups allowing for them to be merged (Table 2.1).

Patients on oncology units were significantly older (t = -7.448, p =.000) with

Table 2.1. Mean Braden Scale Scores by Unit Type.

	Oncology	Nononcology	*t* score	*p* =
N	2473	4385		
Age	60.97	64.21	-7.448	.000
Gender (% male)	44.5%	50.2%	-4.4830	.000
Braden Score on admission *(sd)*	18.98 (1.06)	18.59 (1.05)	5.959	.000
Last Braden Score *(sd)*	18.93 (1.03)	18.81 (.995)	.860	.390

significantly fewer male patients (t = -4.483, p < .001) than nononcology units. Braden Scale scores on admission to the hospital were significantly higher on oncology units, (mean score of 18.95) compared to nononcology units (mean score of 18.59; t = 5.959, p < .001). The last recorded Braden Scale score was not significantly different between the two unit types, 18.93 versus 18.81, respectively. When examined, the mean Braden Scale score on oncology units remained stable across the two time points. Braden Scale scores on the nononcology units went up significantly over time, from 18.59 to 18.81 (t = -.521, p < .001) indicating decreasing risk over time.

To examine this relationship between the Braden Scale score and unit type further, patients in each unit type were categorized by Braden Scale score on admission as at risk for HAPU (score $\leq$ 18) versus not at risk (score > 18; Table 2.2). Significantly more patients on nononcology units were identified as being at risk for an ulcer on admission than patients on oncology units (t =5.348, p < .001).

In the entire sample, all unit types, 143 patients developed at least one HAPU of any stage (Table 2.3). Fifty-eight (58) patients on oncology units developed at least one HAPU of any stage, equal to 40.56% of patients with a HAPU. Unit type was not

Table 2.2. Patients at Risk by Unit.

	Oncology Units		Nononcology Units	
Low Risk (Braden >18)	1850	75.38%	3014	69.30%
High risk (Braden ≤18)	604	24.61%	1335	30.69%
Total	2454	100%	4349	100%

Table 2.3. HAPUs by Patient.

		Oncology unit patients		Nononcology unit patients		Full sample: all units
		N	%	N	%	
All risk levels on admission	Total ulcer (includes present on admission)	157	34.66%	296	65.34%	453
	HAPU	58	40.56%	85	55.56%	143
High risk on admission Braden ≤18	Total ulcer (includes present on admission)	111	32.74%	228	67.26%	339
	HAPU	36	39.13%	56	60.87%	92
Low risk on admission Braden > 18	Total ulcer (includes present on admission)	46	40.35%	68	59.65%	114
	HAPU	22	43.1%	29	56.86%	51

significantly related to HAPU development ($t = 1.006$, $p = .314$). Of the 143 patients who did develop a HAPU, 92 (64.33%) were identified as at risk with a Braden score ≤ 18 on admission. There were no statistical differences by unit type. The rest (51 patients, 35.66%) of patients with a HAPU were not identified as being at risk on admission. There were no statistical differences by unit type.

Discussion

These results are inconsistent with the expectation that oncology patients would be at greater risk for HAPUs than the general hospital population. On admission, patients on oncology units had a significantly higher mean Braden Scale score than patients on nononcology units. The difference was lost over time as the oncology unit mean score remained statistically stable, but the nononcology unit mean Braden Scale score actually increased. A significant improvement was noted on the unit level mean Braden Scale scores between admission and the last recorded score for patients on nononcology units, demonstrating reduced risk for a HAPU. The practical implications of this difference are unclear since both are above the at-risk cut-off of 18, and the tool utilizes whole integers for scoring individual patients. Additionally, the proportion of patients with a HAPU from oncology units is lower than the 48% and 53% found in earlier work (Maide, et al., 2009; Masaki et al., 2007). The failure to identify differences between the oncology and nononcology units may be a result of either the use of units as a proxy for diagnosis, or the use of nononcology specialty units as a subset of the whole hospital reduced the differences in population. Despite the lack of oncology unit specific findings, the data did raise questions about the limits of the Braden Scale for HAPU risk assessment in general.

Overall only 64.3% of HAPUs developed in patients determined to be at risk on admission according to the Braden Scale score. Simultaneously, of all the patients identified as at risk for breakdown (1,939), only 7.3% (143) of them actually developed a HAPU. Over 90% of patients identified as at risk for a HAPU did not develop an ulcer. It is unclear if this is the result of successful interventions to avoid breakdown or poor tool sensitivity. Tool sensitivity has been reported to range from 64 % to 100% (Bergstrom et al., 1998; Bergstrom et al., 1987; Braden & Bergstrom, 1994; Fromantin et al., 2011; Lewicki, Mion, & Secik, 2000). The range of results for sensitivity testing is large and points to a continued need to further understand the risk factors for ulcer development beyond the six captured in the Braden Scale, particularly in oncology.

The unexpected finding that Braden Scale scores failed to change over time in oncology units compared to minor, but statistically significant improvements in the nononcology units is a second area deserving of further investigation. Length of stay, which is not captured in these data, is known to be longer for patients with cancer as the primary or secondary admitting diagnosis than the average hospital stay (Price et al., 2012) suggesting that risk for HAPUs would increase over time on oncology units. The opposite finding in these data is surprising and unexplained. The use of risk reducing interventions was not included in this analysis but may hold the key to explaining these results. If interventions were initiated to reduce risk in those with low scores, the success of the interventions may be demonstrated by the increase in mean unit scores on nononcology units. If this is the case and interventions are applied equally to at-risk patients in both unit types, then it is possible that mean oncology unit scores are staying stable over time because the interventions are countering the expected decline in scores for patients on oncology units. Detailed research examining the interaction of interventions and Braden Scale scores over time for both unit types is needed to evaluate this possibility.

Limitations

Data from NDNQI® has inherent limitations due to the voluntary nature of the database. Hospitals must choose to be members and be willing to commit the resources required of membership. These requirements may result in a notable self-selection bias limiting generalizability. Additionally, this sample used unit placement as a proxy for diagnosis. Only including units with a specialty designation increased the likelihood of a patient being cared for on a unit matched by diagnosis and is the best available proxy for diagnosis when working with the NDNQI® database at the unit level. However, the placement of patients across hospital units is imprecise and unmeasured. Since cancer is a secondary diagnosis for almost three times as many admissions, then it as a primary diagnosis (Price et al., 2012) bed placement may not align. The NDNQI® protocol allows for the specialty designation to be used if 80% of admissions to the unit meet the diagnostic criteria. The percentage of patients with the same diagnosis not placed on the designated unit is unknown. It is entirely possible to have oncology designated units with 80% of patients with having cancer, as well as large percentages of patients on other units also having cancer.

The most significant limitation of these data is the lack of length of stay data. The difference between admission and last Braden Scale score cannot fully be understood without knowing the average time between the two points. When calculated together as a group mean, the interaction of types of cancer, with varying lengths of stay, may be masking specific interaction effects that are predictive of higher HAPU risk. Without detailed breakdown of diagnosis, length of stay, Braden scores over time and HAPU prevalence, full understanding of the risk of HAPUs for oncology patients will remain unclear.

Key Points

- Unit level mean Braden Scale scores are not statistically different between medical oncology and medical surgical oncology specialty units.
- On admission, Braden Scale Scores are higher, indicating less risk for HAPUs on oncology units when compared to nononcology specialty units.
- The Braden Scale score on admission identifies large numbers of patients at risk for skin breakdown who do not develop a HAPU on all unit types.
- Braden Scale scores improved, demonstrating reducing risk for patients on nononcology units while remaining unchanged over time on oncology units.

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CHAPTER 3

HOSPITAL ACQUIRED PRESSURE ULCERS IN ONCOLGOY DESIGNATED UNITS: A PREVALENCE STUDY OF NDNQI® DATA

Abstract

- Purpose/objectives: To describe the prevalence of hospital acquired pressure ulcers (HAPUs) on oncology designated units and compare rates to nononcology units.
- Design: A cross-sectional, secondary data analysis from a national voluntary database.
- Setting: Member hospitals of the National Database for Nursing Quality Indicators (NDNQI®) from across the United States.
- Sample: 149 oncology units and 212 nononcology designated medical surgical units.
- Methods: Descriptive analysis of hospital reported data.
- Main Research Variable: Total pressure ulcers, hospital acquired pressure ulcers and unit acquired pressure ulcers on patients cared for on oncology designated units compared to those on nononcology units.
- Findings: The all stage HAPU prevalence rate was 2.85% on oncology units and 2.64% on nononcology units. The total pressure ulcer rate (HAPUs plus ulcers

present on admission) was 10.88% for oncology units and 11.15% for nononcology units. Neither difference was significant ($p \geq .05$).

- Conclusion: Oncology unit pressure ulcer prevalence is consistent with other specialty units. Prehospital ulcer development affects large numbers of oncology and nononcology hospitalized patients alike.
- Implications for nursing: Prevalence for hospital acquired pressure ulcers appears to have declined compared to historical data, but still represents an unintended consequence of hospitalization for nearly 3% of patients cared for on oncology units. The overall rate of pressure ulcers in patients hospitalized on oncology units is close to 11%, with almost 75% of them present on admission. These data offer an opportunity for oncology nurses to expand the focus of care beyond prevention of pressure ulcers during hospitalization, to healing ulcers present on admission and the prevention of ulcers as discharge education.

Introduction

Patients with cancer and cancer related diagnoses represent a large proportion of hospitalized adult patients. Accounting for 4.7 million discharges in the United States in 2009, over 17% of all adult hospitalizations are for cancer or a cancer related problems (Price, Stranges, & Elixhauser, 2012). No significant difference in cancer hospitalization rates are noted across any region of the country, by income levels, or in rural versus urban locations. Cancer is a secondary diagnosis in 3.4 million hospital discharges. Pneumonia in cancer patients accounts for 20% of these admissions, with septicemia and fluid-electrolyte imbalance adding another 7% (Price et al., 2012).

Despite these high numbers, oncology patients and oncology units are often excluded or remain unspecified in hospital-level analysis of both nursing and hospital quality indicators, including hospital acquired complications. One of the three most frequent hospital complications is a hospital acquired pressure ulcers (HAPUs), that affect almost half a million people annually (Lyder & Ayello, 2008). HAPUs are a progressive complication generally expected to worsen over time resulting in pain, increased posthospital placement in a nursing facility, and increased mortality (The Joint Commission, 2011; Lyder et al., 2012; Pieper, Langemo, & Cuddigan, 2009). The progressive nature of HAPUs suggests the longer a patient is hospitalized, the longer the patient is exposed to the conditions that lead to a pressure ulcer. The average length of stay in U.S. hospitals for all diagnoses is 4.8 days. But the average length of stay for those admitted with cancer as the primary diagnosis is 6.3 days and 8.8 days for septicemia (National Center for Health Statistics, 2013). The large percentage of hospitalizations due to cancer coupled with the longer length of stay begs the question of whether or not people with cancer are particularly vulnerable to HAPUs. International research has repeatedly demonstrated higher incidence and prevalence rates for HAPUs in oncology patients when compared to nononcology patients (Fromantin et al., 2011; Kim, Kim, & Lee, 2010; Maide et al., 2009; Masaki, Riko, Seji, Shuhei, & Aya; 2007). no published data detail the incidence, prevalence, or risk for HAPUs in oncology units in this country.

Background

Any level of skin breakdown extending from reddened areas, including full thickness injury and exposure of underlying structures, particularly when caused by pressure or pressure made worse by shearing, is a pressure ulcer (National Pressure Ulcer

Advisory Panel-European Pressure Ulcer Advisory Panel [NPUAP-EPUAP], 2009). At its most basic, long periods of immobility typically experienced in relationship to hospitalizations place patients at risk for skin breakdown. Patients, like those with oncology diagnoses, repeatedly hospitalized due to advancing and complex illness, are expected to be at increased risk for HAPUs from the point of admission (Tescher, Branda, Byrne, & Naessens, 2012).

The risk for HAPU development is multifactorial and generally increases as the number of risk factors increases (Alderden, Whitney, Taylor, & Zaratkiewicz, 2011; Bry, Buescher, & Sandrik, 2012; VanDenKerkhof, Friedberg, & Harrison, 2011). Sensory-perception impairment, mobility limitations, moisture exposure, decreased nutrition, and the risk of friction and shear injuries are the most well documented risk factors for HAPUs. Additional risk factors include vasopressor infusions, spinal cord injury, advanced age, low body mass index, multiple comorbidities, general debility, and a high severity of illness (Alderden et al., 2011; Bry et al., 2012). The diagnoses of cancer, congestive heart failure, chronic obstructive pulmonary disease, stroke, and diabetes are statistically correlated to HAPU development (Lyder et al., 2012). Although not tested for causality, numerous laboratory findings including hypoalbuminia, anemia, and low lymphocyte counts are commonly found in patients with pressure ulcers (Alderden et al., 2011; Bry et al., 2012). Many of these items are common occurrences both for people with cancer and patients in the last 6 months of life regardless of cause (Alderden et al., 2011; Maida et al., 2008). Cancer patients are hospitalized frequently toward the end of life, with over 60% of cancer patients being admitted at least once in the 30 days prior to death (Dartmouth Institute for Health Policy and Clinical Practice, 2013). The totality of risk factors for HAPUs faced by people with cancer makes the lack of knowledge regarding HAPU prevalence in the United States oncology population a significant gap in the literature.

HAPUs are classified by stages according to the extent of injury, an effect of both accumulated risk factors and the passage of time. The combination of the two is imprecise. The most recent revisions of the staging tool were complete in 2007 and include six categories: stages 1–4, unstageable, and suspected deep tissue injury (NPUAP-EPUAP, 2009). Although the time elapsed for an ulcer to evolve from Stage 1 to Stage 4 is not defined, it is predictable that left alone without changes in the conditions contributing to the ulcer, an ulcer will progress, worsening over time. As a result of the impact of time, those patients with longer hospitalizations are generally considered to be at greater risk for HAPU development.

In 1989, NPUAP partnered with a hospital bed manufacturer, Hill-Rom, to conduct an annual, voluntary survey of HAPUs. Survey participation grew from 148 facilities in the first year to 932 in in 2011. In the last 5 years of available data, total ulcer prevalence has dropped from 13.3% in 2006 to 10.8% in 2011, while the subset of ulcers originating in the hospital decreased 6.4% to 4.5% (VanGilder, Lachenbruch, Harrison, Davis, & Meyer, 2012). The HAPU decrease comes almost exclusively in the stage 1 ulcers while the percentage of all subsequent stages remained stable. This report does not separate oncology patients or units specifically.

International research repeatedly points to a higher incidence of pressure ulcers in those with cancer than without (Kim, Kim, & Lee, 2010; Maide et al., 2009; Masaki, Riko, Seji, Shuhei, & Aya, 2007). A 2-year analysis of all HAPUs in a Japanese medical center determined that a cancer diagnosis alone was predictive of skin breakdown (p =.04), and 48% of all HAPUs were in patients with cancer (Masaki et al., 2007). A series of studies in a Toronto hospital palliative care unit concluded that 53% of patients with cancer developed a pressure ulcer and of these patients, the presence of pressure ulcers of any stage was highly associated with earlier death (hazard ratio 1.85, 95% confidence interval 1.44–2.37, $p < 0.0001$; Maida et al., 2008; Maida, Ennis, Kuziemsky, & Corban, 2009). These results echo the only cancer-specific research in the U.S.; that prospectively examined risk factors for skin breakdown in hospitalized patients and identified that 85% of patients with cancer developed pressure ulcers, whereas only 70% of the noncancer patients developed an ulcer (Waltman, Bergstrom, Armstrong, Norvell, & Braden, 1991).

The most recent and largest examination of HAPUs in oncology was a 2009 follow up to a French study originally conducted in 2002 (Fromantin et al., 2011). Researchers working to develop a HAPU risk assessment tool specific to oncology patients, The Curie Scale, first tested in comparison to the Norton Scale for risk assessment, the most commonly utilized pressure ulcer assessment tool in France at the time. A total of 351 patients were included in the sample, and a 5% prevalence rate for all stage HAPUs was established. The two scales demonstrated a high level of concordance ($r = -0.83$, $p < 0.001$). After detailed analysis, The Curie Scale was modified and renamed the Pressure Ulcer Scale in Oncology (PUSO). The PUSO only includes three components: mobility, continence, and moisture/shearing. The PUSO was then tested with the same methods as the Curie Scale except the Braden Scale replaced the Norton Scale as the control since it had become the more frequently used tool with greater validity (Fromantin et al., 2011). The prevalence rate remained stable at 5%, and the

PUSO was strongly correlated with pressure ulcer prevalence ($p < 0.00001$).

This evidence of a stable rate of HAPUs in oncology patients over time offers the clearest picture for establishing a baseline. However, current prevalence rates in the United States are not known. It is important to note the largest of the international studies were drawn from hospitals exclusively treating cancer patients. Although there are oncology exclusive hospitals in the United States, 85% of cancer patients are cared for in general hospitals (National Cancer Institute, 2010). The largest report of HAPU prevalence in United States hospitals to date, a retrospective secondary analysis of Medicare patients hospitalized for any reason between 2006 and 2007, demonstrated a 4.5% overall incidence rate for the development of at least one new pressure ulcer during hospitalization and 5.8% rate for ulcers present on admission (Lyder et al., 2012). This suggests possible concordance in rates between the United States general hospital population and hospitalized oncology patients in France. Data from the National Database of Nursing Quality Indicators (NDNQI®) comparing HAPU prevalence from 2004, 2006, and 2010 demonstrated a decrease in overall adult HAPU prevalence for all stage ulcers from 6.4% in both 2004 and 2006 to 3.8% in 2010 (Bergquist-Beringer, 2011). These results support the prevalence rates from the earlier studies and suggest changes in hospital conditions between 2006 and 2010. This drop was further documented with an analysis of the seasonality of HAPUs. Researchers examined NDNQI® data from 2004 to 2011 and reported a consistent downward trend in HAPU prevalence. HAPU rates were found to be significantly higher in the first quarter months (January–March) than at any other time of the year across all years of the study (He, Staggs, Bergquist-Beringer, & Dunton, 2013).

HAPUs are a significant source of morbidly, mortality, suffering, and cost for patients in United States' hospitals. The list of risk factors for developing a HAPU is extensive and includes the diagnosis of cancer as well as many common cancer related problems like cachexia and anemia. Regardless of these factors, no data exist to document the prevalence of HAPUs in oncology units in the United States. This gap leaves oncology patients at a potential disadvantage as the lack of specific data defining the problem may divert attention away from HAPU recognition and reduction efforts on oncology units. An in-depth description of unit level prevalence compared to rates in other medical surgical units will help to define the scope of the problem. The aim of this research is to describe HAPU rates on oncology units in the United States and compare them to HAPU rates on nononcology units.

Methods

This research was a retrospective, descriptive analysis of secondary, deidentified data from the National Database of Nursing Quality Indicators (NDNQI®). All data were used with permission from NDNQI®. The American Nurses Association established NDNQI® as a longitudinal database to support research regarding the link between nursing care and patient outcomes (Dunton et al., 2007). HAPUs, the risk for developing a HAPU, and subsequent prevention efforts to avoid HAPUs have been included in the database from the beginning (Dunton, Gajewski, Klaus, & Pierson, 2007). NDNQI® member hospitals who choose to report skin data must comply with a standard data collection protocol reviewed regularly by the University of Kansas Institutional Review Board. To start, hospitals identify specific nurses to conduct a quarterly patient survey. The nurses first complete training provided by NDNQI® and then identify 1 day per quarter to collect data. On this day, nurses complete a head to toe skin assessment, document all areas of breakdown, and complete a chart review to gather the rest of the data on each patient on each unit in the hospital. Skin breakdown is classified according the NPUAP-EPUAP (2009) staging guidelines.

All pressure ulcers are categorized by the point of origin. If an ulcer was documented in the patient record on admission to the hospital, it is included in the total ulcer count but not the hospital acquired count. Only ulcers not identified on admission are identified as hospital acquired. Unit acquired ulcers are a subset of hospital acquired ulcers. Since patients often change units during a hospitalization, unit acquired ulcers are those that developed while the patient received care on the same unit they are on for the day of data collection. The NDNQI® process for skin data collection was tested for interrater reliability in 2005. Over 250 individuals representing 48 member hospitals trained to do data collection took part in reliability testing of the process. The ability to identify pressure ulcers verses nonpressure ulcers for all participants demonstrated high reliability (k = 0.84, SD = 0.25) and participants demonstrated moderate agreement (k = 0.65, SD = 0.21) at staging pressure ulcers (Hart, Berquist, Gajewski, & Dunton, 2006).

Setting and Sample

NDNQI® encourages all participating hospitals to identify units according to three levels: by patient age, adult or pediatric, general acuity; critical care or medical-surgical; and unit specialty. Within the adult, noncritical care group, numerous specialty unit designations are available. To qualify for these designations 80% of admissions must meet the specialty diagnosis. Two different options are available for the oncology specialty: adult medical oncology or adult medical-surgical oncology. Nononcology specialty units are neurology, infectious disease, gastrointestinal, respiratory, cardiac, renal, neuro/neurosurgery, and med-surg cardiac. This analysis included data from noncritical care, specialty designated units from United States member hospitals, which reported both pressure ulcer data and nurse survey data in 2012. To avoid the seasonal spike in HAPUs prevalence, data from only the second quarter were included.

Data Analysis

Patient data were provided by NDNQI® identified by unit and hospital. Analysis took place in two steps. First, data from units that self-identified as either adult medical oncology or adult medical surgical oncology were compared. Prevalence rates for each unit type for total ulcers, hospital acquired and unit acquired ulcers all stages, and unit acquired ulcers stage 1–4 were calculated as a percentage of patients with one or more ulcers among all patients assessed. Unit means by category were then compared using independent *t*-tests. After this, medical oncology and medical surgical oncology units were merged and compared to nononcology specialty units using the same tests.

Results

Medical Oncology and Medical Surgical Oncology Units

The sample included 89 medical oncology units and 59 medical surgical oncology units with 2816 individual patients assessed (Table 3.1). Medical oncology units were significantly more likely to be from larger hospitals or teaching hospitals. Forty-nine percent of medical oncology units were from Magnet hospitals, as were 53% of medical surgical oncology units. Patient age was comparable at 61.23 years and 60.29 years.

Both unit types demonstrated large differences between the total numbers of

Table 3.1. Oncology Unit: Demographics.

	Medical Oncology units	Medical surgical Oncology units	*t* =	*p* =
N (units)	89	60		
# of patients	1747	1069		
Mean patient age in years	61.23	60.29	.844	.400
Bed size**+	4.3	3.63	2.94	.004
Teaching status**++	2.04	2.42	-2.972	.003
Magnet	49%	53%	-.464	.644
Mean # of total ulcers/unit all stages**±	.1221	.0891	1.226	.222
Mean # of hospital acquired ulcers/unit all stages±	.0271	.0306	-.376	.707
Mean # of unit acquired ulcers all stages±	.0200	.0220	-.279	.781
Mean # of unit acquired ulcers stage 1**	.0084	.0017	2.184	.031
Mean # of unit acquired ulcers stage 2	.0070	.0115	-.957	.340
Mean # of unit acquired ulcers stage 3	.0010	.0017	-.388	.699
Mean # of unit acquired ulcers stage 4	0	0	na	na

** = significance $p \leq .05$
+ Bed size: 1= <100; 2 = 100–199, 3 = 200–299, 4 = 300–399, 5 = 400–499, 6 = ≥500
++ Teaching status: 1= academic medical center; 2 = teaching, 3 = nonteaching
± includes Stage 1–4, eschar, unstageable, sDTI

ulcers per patient and the hospital acquired count. The category of total ulcers includes both ulcers present on admission and hospital acquired ulcers of all stages (Table 3.2). Medical oncology units had a 12.21% total ulcer rate and medical surgical units, 8.91%. HAPU rates were 2.71% on medical oncology and 3% on medical surgical oncology units. Unit acquired rates, a subset of the HAPU rate, for all stage ulcers were 2.0% and 2.2%, respectively. Only prevalence rates for unit acquired stage 1 ulcers (.84% and .17%, respectively) demonstrated significance difference between units (t = 2.184, p =.031). Rates for ulcers of all stages that were present on admission were calculated. Although not statistical significant, patients on medical oncology units were almost twice as likely to have an ulcer on admission as those on medical surgical oncology units with rates at 9.49% and 5.85%.

Oncology and Nononcology Units

The medical oncology and medical surgical oncology units were combined to compare rates with nononcology specialty units. The nononcology sample included 212 units including 5001 individual patient assessments. There was a significant difference noted in patient age between the two groups (t = -3.896, p =.000) with nononcology patients averaging 63.75 years to oncology patients at 60.84 years (Table 3.3). Bed size and teaching status remained significantly different with nononcology units more likely to be from larger hospitals and nonteaching hospitals. The mean total ulcer count per unit was significantly higher in nononcology units (t = -2.150, p =.032). But no other significant differences were noted across unit types for mean ulcer count. Prevalence rates were comparable for all ulcer types as well (Table 3.4).

Table 3.2. Oncology Units: Prevalence.

	Medical Oncology Units		Medical Surgical Oncology Units		$p =$
	Rate	Standard Deviation	Rate	Standard Deviation	
# of patients assessed	1747		1069		
# of units	89		60		
Total ulcer rate all stages ± (prehospital + hospital acquired)	**12.21%**	**18**	**8.91%**	**13.05**	**.22**
Prehospital ulcer rate all stages±	9.49%	17.16	5.85%	10.74	.146
Hospital acquired rate all stages±	2.71%	4.05	3.06%	7.06	.707
Unit acquired ulcer rate all stages±	2.0%	3.44	2.20%	5.03	.781
Unit acquired Stage 1 rate	0.84%	2.23	0.17%	1.26	.054
Unit acquired Stage 2 rate	0.70%	1.91	1.15%	3.48	.340
Unit acquired Stage 3 rate	0.10%	.92	0.17%	1.26	.699
Unit acquired Stage 4 rate	0%	0	0%	0	na

± includes Stage 1–4, eschar, unstageable, sDTI

Table 3.3. Oncology Units and Nononcology Units: Demographics.

	Oncology units	Nononcology units	*t* =	*p* =
N (units)	149	212		
Mean patient age in years	60.84	63.75	-3.896	.000
Bed size**+	4.03	4.36	-2.123	.034
Teaching status**++	2.19	2.04	1.862	.063
Magnet	51%	51%	-.076	.0939
Mean # of total ulcers/unit all stages**±	1.88	2.52	-2.150	.032
Mean # of hospital acquired ulcers/unit all stages±	.5235	.6462	-1.078	.282
Mean # of unit acquired ulcers all stages±	.3881	.4639	-.682	.496
Mean # of unit acquired ulcers stage 1	.1045	.1443	-.798	.426
Mean # of unit acquired ulcers stage 2	.1642	.1804	-.280	.780
Mean # of unit acquired ulcers stage 3	.0149	.0206	-.326	.745
Mean # of unit acquired ulcers stage 4	0	.0103	-1.178	.158

** = significance $p \leq .05$
+ Bed size: 1= <100; 2 = 100–199, 3 = 200–299, 4 = 300–-399, 5 = 400–499, 6 = ≥500
++ Teaching status: 1 = academic medical center; 2 = teaching, 3 = nonteaching
± includes Stage 1–4, eschar, unstageable, sDTI

Table 3.4. Oncology Units and Nononcology Units: Prevalence.

	Oncology Units		Nononcology Units		*p* =
	Rate	Standard Deviation	Rate	Standard Deviation	
# of patients assessed	2816		5001		
# of units	149		212		
Total ulcer rate all stages ± (prehospital + hospital acquired)	**10.88%**	**16.1**	**11.15%**	**14.15**	**.862**
Prehospital ulcer rate all stages±	8.02%	14.57	8.51%	13.07	.742
Hospital acquired rate all stages±	2.85%	5.5	2.64%	5.07	.706
Unit acquired ulcer rate all stages±	2.08%	4.1	1.85%	4.42	.644
Unit acquired Stage 1 rate	.58%	1.9	.58%	2.04	.997
Unit acquired Stage 2 rate	.88%	2.6	.73%	2.4	.602
Unit acquired Stage 3 rate	.13%	1.0	.06%	.51	.417
Unit acquired Stage 4 rate	0	0	.04%	.04	.177

± includes Stage 1–4, eschar, unstageable, sDTI

Discussion

No significance differences in HAPU prevalence was identified between oncology designated units and nononcology designated units. The total ulcer rate is consistent with that reported in the majority of the previous literature, but the hospital and unit acquired rates are notably lower. This change is consistent with other data collected after 2008 (He, Staggs, Berquist-Beringer, & Dunton; 2013; VanGlider, Lachenbruch, Harrison, Davis, & Meyer, 2012) suggesting either actual reductions in HAPUs or improved documentation of ulcers present on admission.

National conditions surrounding HAPU care and prevention must be considered when evaluating these results. Data sources utilized to develop this study relied upon HAPU reports prior to 2008, a significant turning point for HAPUs in the United States. As of October 1, 2008, CMS stopped paying hospitals for the care provided to manage a late stage (Stage 3 or 4) HAPU. Calling HAPUs the most common preventable complication of hospitalization, CMS ceased payments to hospitals who allowed them to develop. The impact of this policy is only beginning to be documented but is likely a partial explanation for the results of this study.

This policy change is a substantial motivator for hospitals to implement institutional level prevention plans. The five key interventions to reduce HAPU risk identified in clinical practice guidelines are: use of pressure reducing surfaces, regular turning and repositioning, moisture management, daily skin assessments, and nutritional support (Institute for Clinical Systems Improvement [ICSI], 2012). Although all five could be independent nursing actions based on individual patient assessments from existing tools such as the Braden Scale, they are amenable to organization-wide implementation. In fact, if viewed as a clinical bundle, they are easily implemented as positive, patient care practices for all hospitalized patients regardless of individual risk for skin breakdown. The use of these interventions may be the reason for the reduced HAPU rates.

Alternatively, many hospitals invested in large documentation efforts to clearly capture ulcers present on admission and avoid the appearance of a HAPU (McHugh, Van Dyke, Osei-Anto, & Haque, 2011). The difference between community or prehospital acquired ulcers and HAPUs hinges on the admission assessment. The standardization of a skin/ulcer assessment on admission with a focus on documenting preexisting conditions is another organizational-wide practice that may have significantly changed since 2008. The dramatic shift in prevalence rates for HAPUs with only a small reduction in total ulcer rates introduces the possibility that poor charting historically was the root cause of higher HAPU rates. The question of whether HAPU rates actually decreased by half or charting efforts double since 2008 needs to be considered. Significant improvements in the use of risk-reducing interventions or improvements in the accuracy of admission charting may have occurred as a result of the change in payment structure. This payment policy may be such a significant change in all of the circumstances surrounding HAPUs that attempts to compare prevalence before and after 2008 are of limited value.

Regardless of why HAPU rates are decreasing, the stable total ulcer rate points to the need for a shift in thought and focus regarding pressure ulcers. The current focus has been on pressure ulcers as an adverse hospital event. These data point to the need to broaden pressure ulcer reduction efforts beyond the hospital. The prevalence of prehospital or community acquired ulcers is over 8% for all groups sampled. Patients on medical oncology units had the largest prevalence of ulcers on admission, 9.49%. This is consistent with the generalized debility of people with cancer and the large volume of admissions for these patients in the last weeks of life. The focus on HAPU development, although still valuable, needs to shift to focus on care provided to at-risk patients in a variety of settings. The possibility exists that poor charting of ulcers on admission was the real catalyst behind the perceived HAPU rates in past years. If this is the case, then the perceived success of reduced HAPU prevalence is only a success for charting accuracy. The patient burden from pressure ulcers has not been reduced only moved to nonhospital care sites. More detailed analysis of the differences between total ulcers and HAPUs is required to fully investigate this possibility and shift the focus off the hospital process and on to the patient experience.

Oncology nurses do not need to wait for definitive data to expand consideration of pressure ulcer development to all care locations. Hospital nurses can include pressure ulcer prevention teaching for patients prior to discharge to help reduce overall risk and see improvement in pressure ulcer prevention as an important opportunity of hospitalization. Nurses working across the care continuum in any setting with access to cancer patients can seek opportunities to reduce pressure ulcer risk by exploring how to apply hospital based guidelines to match the location of care. Additionally, increased attention to patients with ulcers on admission is warranted both to understand the conditions that led to the ulcers and best practices for healing ulcers. In cancer, the connection between pressure ulcer presence and life expectancy may offer an opportunity to discuss disease trajectory and support advanced decision making for families.

Limitations

The imprecise relationship between oncology designated units and people with cancer must be included in any evaluation of these data. Most of the international data on HAPUs and oncology patients originate in hospitals exclusively caring for people with cancer. This analysis included all NDNQI® member hospitals without identification of cancer only hospitals. It separated oncology patients by unit designation, relying on the NDNQI® unit descriptor as a proxy for diagnosis. Patient placement within hospitals is imprecise. Bed availability, admitting physician, and admitting diagnosis are influential aspects of bed placement, but many other factors may affect what unit a patient is placed. Without knowing individual patient diagnoses, the exact relationship between pressure ulcers and cancer cannot be fully quantified. The gap between these data and previous international data should be further explored with an analysis of HAPUs in cancer-only hospitals in the U.S.

Application of these data is likewise limited by the database. As a voluntary member-only database, NDNQI® is not representative of all hospitals. In this sample, over 50% of all units reported being from a Magnet designated hospital. Only 7% of all hospitals in the U.S. have earned Magnet designation. Units were evenly split between Magnet and non-Magnet in this sample, resulting in no significant differences in the comparison groups but posing a clear limitation to generalizability of the results.

Finally, the lack of length of stay information in the database is a considerable limitation to this research. Time is a critical component of pressure ulcers. These data have no information about how long patients were admitted, how many admissions they had, or changes in ulcer staging between time points. Future research would benefit from the addition of measures of time in the hospital and on the unit to more fully evaluate the impact of length of stay on ulcer development and continue to move the conversation toward skin breakdown as a patient condition beyond a hospital adverse event.

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CHAPTER 4

A DESCRIPTIVE ANALYSIS OF THE NURSE PRACTICE ENVIRONMENT ON ONCOLOGY DESIGNATED UNITS COMPARED TO NONONCOLOGY SPECIALTY UNITS

Abstract

- Background: In 2009, 4.7 million adult hospitalizations were for cancer or cancer-related diagnoses. Oncology designated units specialize in care of cancer patients, yet are rarely included in hospital quality and patient safety research. Nursing is a critical component of hospital quality and nurse sensitive patient outcomes research. The practice environment of nurses has repeatedly demonstrated a positive and significant link with numerous patient outcomes. Understanding the practice environment for nurses on oncology units is necessary to evaluate potential unit differences impacting patient quality and safety measures.
- Objectives: To describe the nurse practice environment on medical oncology and medical surgical oncology units and compare it to nononcology specialty units.
- Population: 1291 adult, noncritical care, nonmaternity units, from acute care hospital units in the United States.
- Methods: The nurse practice environment, measured by the Practice Environment Scale of the Nursing Work Index, of oncology designated units was compared using independent sample *t* tests with nononcology specialty units.

- Results: In general, nurses report positive work environments on medical oncology, medical surgical oncology and nononcology units. No significant differences ($p \geq .05$) were found in mean scores on any subscale between groups. Results are limited by notable overrepresentation of Magnet award hospitals in the sample.
- Conclusions: Oncology units' similarity with nononcology specialty units reduces the need to repeatedly sample unit types individually and supports the application of nurse practice environment evidence from other unit types to oncology units.

Background

In 2009, over 20 billion dollars were spent on 1.2 million hospitalizations for a primary diagnosis of cancer. Another 3.4 million hospitalizations, at a cost of $38.5 billion, included cancer as a secondary diagnosis (Price, Stranges, & Elixhauser, 2012). Patients admitted for cancer have an average length of stay almost 2 days longer and cost $6,000 more than admissions for all other reasons (Price et al., 2012). Cancer patients are an average of 2.5 years older than the general hospital population and have an in-hospital death rate more than twice that of all other primary diagnoses (Price et al., 2012). These trends show no significant differences across regions of the country, by income levels, or in rural versus urban locations.

Cancer and cancer-related illnesses are a significant driver of hospital admissions. Despite the preponderance of cancer diagnoses, research examining quality and safety in hospitals rarely includes these patients specifically. Quality has historically been measured at the hospital level, but efforts to get closer to the point of care have sought unit level measures. Differences between units in the same hospital may impact patient outcomes as a result of structural or process differences. Research conducted in like units, most frequently critical care units, supports commonalities across hospitals based on the unit type. Patient population differences, captured in unit type, may impact the interpretation and application of hospital level quality data. The bulk of research at the unit level has focused on the differences between critical care units and medical-surgical units (Kane, Shamliyan, Mueller, Duval, & Wilt, 2007). Within these larger unit types, there are even more specific unit groupings still unexplored.

Cancer units are a common specialty within the medical-surgical unit type that has been largely unexplored. Without side-by-side comparison, it is difficult to discern the unique needs of cancer patients within the medical-surgical or general hospital population. The large volume of cancer diagnoses in hospitals is ample reason to question the applicability of general hospital data for these unique patients. Exploring unit-based differences in variables significant to patient outcomes will be helpful to identify opportunities for improvement.

Nurses, as a variable in hospitals, are the subject of many volumes of research in relationship to patient quality, safety, and outcomes. The Institute of Medicine (IOM) (2004) identified nurses as a critical link to patient safety in hospitals and further identified the work environment of nurses as key to improving patient safety. Efforts to define variables within the nurse work environment long focused on staffing without clear conclusions (Kane, Shamliyan, Mueller, Duval, & Wilt, 2007). Other components of the environment including work hours, work design, leadership, patient acuity, and nurse education have been inconclusive. One limitation of this work was the effort to isolate each component as an independent variable and measure its specific impact.

Efforts to conceptualize the nurse work environment as the totality of these components led to the Practice Environment of the Nursing Work Index (PES-NWI)(Lake, 2002).

The PES-NWI captures the perspective of nurse respondents along multiple dimensions of work. It seeks to evaluate the aspects of the environment that impact the practice of professional nursing (Lake, 2002). The tool is designed to capture the construct of the work group in hospitals of nurses on the same unit and measure the collective perspective of the team working most closely together. The tool surveys nurses' perspectives on the work environment along five subscales: 1) physician-nurse relationships; 2) nurse manager ability, leadership, and support; 3) staffing and resource adequacy; 4) quality foundations of practice; and 5) participation in organizational decisions and generates a mean composite score. Tool validity has been repeatedly established (Choi & Boyle, 2014; NQF, 2012; Warshawsky & Havens, 2011). In a summary to the tool, the National Quality Forum (NQF) reported the PES-NWI had been used in 70 published research studies and translated into 23 languages (NQF, 2012). It was named as one of the 15 items included in the National Voluntary Consensus Standards for Nursing Sensitive Care by the NQF (2004). The Joint Commission added the PES-NWI to its accreditation standards in 2009 as a screening indicator for hospital staffing effectiveness (The Joint Commission, 2009).

Research using the PES-NWI to measure nursing practice environments demonstrated consistent positive relationships with nursing outcomes such as job satisfaction, intent to leave, and burnout, as well as organizational factors such as teaching status and Magnet hospital designation, the award for excellence given by the American Nurses Credentialing Center (Warshawsky & Havens, 2011). Most recently, research has linked scores on the PES-NWI to patient outcomes. To date, two measures of mortality, 30-day post discharge mortality and in-hospital death due to an avoidable complication known as failure to rescue, are the most common patient outcomes studied in relation to the nurse work environment.

Three large studies published since 2008, all working with 30-day mortality and failure to rescue as endpoints, utilized the PES-NWI as a measure of the nurse practice environment (Aiken et al., 2008; Aiken et al., 2011; Friese, Lake, Aiken, Silber, & Sochalski, 2008). Aiken et al., (2008) analyzed the net effect of nurse practice environments on patient outcomes after controlling for nurse staffing and nurse education. Friese et al. (2008) utilized the same data set and procedures, but limited the sample to surgical oncology patients. Using PES-NWI results broken into categories of low, medium, and high scores, nursing environment demonstrated a significant relationship to both mortality measures in both studies. Subsequently, researchers expanded to surgical patients across four states (Aiken et al., 2011) and demonstrated consistent results. These studies demonstrated significant support for the overall impact nurses, and particularly their work environment, have on patient care at the hospital level. This work has not yet been replicated in medical patients, but the consistency between results for all surgical patients and the subset of surgical oncology patients supports applicability of findings across hospitalized cancer patients.

The link between the nurse work environment and nonmortality patient outcomes is limited, but a positive relationship has been demonstrated with pressure ulcers in nursing homes (Flynn et al., 2010) and with medication errors in hospitals (Flynn et al., 2012). After matching nurse survey results on the PES-NWI to publicly available data regarding nursing home quality found in the Nursing Home Compare database, Flynn et al (2010) found the PES-NWI total score and four of five subscale scores were significantly and inversely related to the percentage of residents with pressure ulcers. Only the nurse manager ability, leadership, and support scale were not significantly related to pressure ulcer development. In the second study, researchers examined 82 medical surgical units from 14 hospitals and evaluated RN use of medication error interception practices with PES-NWI scores. Results demonstrated a positive and significant correlation between error interception practices and the unit mean PES-NWI score, as well as four of the five subscales. Only the subscale of staffing and resource adequacy failed to demonstrate a significant relationship. These findings support the positive relationship between nurse work environment and patient outcomes extending beyond mortality measures. Conversely, two unpublished pilot projects examining falls with injury and HAPUs on oncology units failed to find a significant link with unit level PES-NWI on oncology units. Both studies were small, exploratory studies testing mediation analysis of the relationship between nurse environment and patient outcomes in oncology. The lack of significant findings specific to oncology units increases the need to understand the variability of the practice environment between unit types to support future research designs.

Research using the PES-NWI offers the opportunity to examine outcomes at the unit level instead of the hospital level. The move to the unit level encourages research on specific patient populations like cancer patients, often clustered together on designated units. An examination of the practice environment of oncology units specifically will help define aspects of care unique to cancer patients and provide an opportunity to gauge the need for future research at this level.

The aim of this study was to describe the nurse practice environment on oncology designated units in the U.S. and compare it to the environment on other specialty unit types. PES-NWI score ranges at the hospital level are available in the literature. Most recently, Choi and Boyle (2014) reported unit level mean scores for each subscale and the total PES-NWI score for 11 unit types. Oncology units were not included, leaving a gap in the ability to gauge unit based differences specific to cancer care.

Methods

This study was a descriptive, cross-sectional, analysis of data collected by NDNQI® in 2012 from member hospitals utilizing the RN Survey with Practice Environment Scales. NDNQI® is database operated by the American Nurses Association to collect and disseminate information regarding nursing quality. Member hospitals may choose to participate in an annual nurse survey. To do so, the hospital chooses a time of year to conduct the survey and a site coordinator. The coordinator works via a secure site and is trained in the survey protocol to enter hospital information regarding bed size, number of nurses, unit type, size, and number. NDNQI® protocol determines when and how to advertise the survey and provides guidelines for encouraging nurse participation in the survey. All registered nurses working at least part time, with at least 3 months of employment and spending at least 50% of their time in direct patient care, are eligible to take part. Staff nurses are provided a hospital specific ID to use when logging onto the secure website, and names are never recorded. The survey is available for 3 weeks, and during that time, the site coordinator can monitor the number of participants by unit. This protocol is reviewed regularly by the University of Kansas Institutional Review

Board, and individual hospitals are encouraged to have their local review boards also review the protocol.

NDNQI® only reports unit level data if there are a minimum of 5 respondents equaling a response rate of at least 50%. In 2012, 1291 adult, nonmaternity, noncritical units from 438 different hospitals met these standards. NDNQI® protocol allows, but does not require, hospitals to identify a unit specialty, if at least 80% of the admissions meet the patient population definition. Of the 1291 units reporting data, only the 379 units identified a specialty. Only units with a specialty were included in this study. There were 91 medical oncology units and 64 medical surgical oncology units for 155 total oncology units. Another 224 units were identified as one of the following: neurology, infectious disease, gastrointestinal, respiratory, cardiac, renal, neuro/neurosurgery, or medical-surgical cardiac. These units were combined and comprise the nononcology units.

This analysis progressed in two stages. First, the medical oncology units were compared to medical surgical oncology units using independent *t* tests to determine group differences in hospital characteristics, nurse characteristics, and PES-NWI scores. Second, the two types of oncology units were combined and compared to the nononcology units using the same tests.

Results

Medical Oncology and Medical Surgical Oncology Units

Overall, few differences were identified between the medical oncology and medical surgical oncology units (Table 4.1). The 155 units were from 141 different hospitals. Medical oncology units were more likely to be from larger hospitals (>300

Table 4.1. Oncology Units: Nurse Demographics.

	Medical Oncology Units	Medical Surgical Oncology Units	*t* =	*p* =
N	91	64		
Bed size**+	4.3	3.64	3.007	.003
Teaching status**++	2.05	2.44	-3.156	.002
Magnet	.48	.50	-.201	.841
Participating response rate	80	81	-.006	.995
% female	93.87	94.64	-.669	.504
% race white	76.08	72.44	.907	.366
% mean age**	39.27	40.16	-2.676	.008
yrs in practice in US**	9.51	10.80	-2.336	.021
yrs on unit**	5.51	6.64	-2.792	.006
job plans-remain in same job	77.20	77.39	-.090	.928
Nrsg BS degree	57.21	52.51	1.646	.102
Certification awarded by national nursing association	26.45	23.49	..726	.469

** = significance $p \leq .05$
+ Bed size: 1= <100; 2 = 100–199, 3 = 200–299, 4 = 300–-399, 5 = 400–499, 6 = $\geq$500
++ Teaching status: 1 = academic medical center; 2 = teaching, 3 = nonteaching
± includes Stage 1–4, eschar, unstageable, sDTI

beds) and nonteaching hospitals (t = 3.00 p = .003; and t = -3.16, p =.002, respectively). Nurses on the medical-surgical oncology units were older with more years of experience on the unit than their medical oncology counterparts (t = 2.68, p =.008; and t = 2.80, p =.006, respectively). There were no differences between the groups on measures of nursing education or national certification.

PES-NWI scores are reported for five subscales: 1) participation in hospital affairs; 2) nursing foundations for quality of care; 3) nurse manager ability; leadership and support; 4) staffing and resource adequacy; and 5) collegial nurse-physician relationships and a total mean score. Scores are reported on a 1–4 scale, with 1 being very poor and 4 being the best. Each subscale is composed of a series of three to 10 questions. The total mean score is calculated as the mean of the five subscales.

Medical oncology and medical surgical oncology units demonstrated no differences in mean scores on any of the subscales or the total PES-NWI score (Table 4.2). All subscales were generally rated positively. The lowest score was 2.62 for staffing and resource adequacy on medical oncology units. Medical oncology units rated the nursing foundations for quality of care 3.16, the highest of all the ratings.

Oncology and Nononcology Units

When combined, the oncology units ranged in size from 10 to 68 nurses eligible for the survey, with a mean response rate of 80%. Respondents were 94% female, averaging 39 years old with a range from 28 to 51 years. They were predominately White (74.58%) and working full time (81%), with an average of 10 years in practice, 6 years on the same unit, and 77% reported plans to stay on the unit for the next year. Nursing educational preparation mirrors the national trends with 35% of staff reporting an

Table 4.2. Oncology Units PES-NWI.

Mean score (SD)	Medical Oncology Units	Medical Surgical Oncology Units	*t*	*p*
Involvement in hospital affairs	2.95 (.283)	2.88 (.226)	1.561	.121
Nursing foundations for quality of care	3.16 (.225)	3.12 (.174)	1.306	.194
Nurse manager ability, leadership and support	3.05 (.339)	2.97 (.304)	1.643	.102
Staffing and resource adequacy	2.62 (.404)	2.59(.324)	.509	.612
Collegial nurse-physician relationships	3.04 (.273)	3.03 (.174)	.281	.779
Total score	2.96 (.273)	2.92 (.204)	1.182	.239

Associate's Degree (AD) as their highest nursing degree and 55% reported a Baccalaureate Degree (BSN) as their highest nursing degree. Fifty-eight percent of the oncology units were in teaching hospitals, 60.7% were from hospitals with >300 beds, and 50% were from Magnet designated hospitals.

Nononcology unit size ranged from eight eligible nurses to 87, with a mean of 32 and a mean response rate of 81%. Nurses were 91% female, averaged 38 years old, ranged in age between 28 and 53, and were 65% White. Eighty-four percent work full time, with an average of 9.3 years in practice, 5.5 on the same unit, and 73% intend to stay on the unit for another year. Just over half (54%) report holding a BSN with 37% reporting an AD has their highest nursing degree. In this group 64% hold a certification in a nursing specialty awarded by a national nursing association.

There were many significant differences between oncology nurses and nononcology nurses (Table 4.3). Oncology nurses are significantly more likely to be

Table 4.3. Oncology and Nononcology Units Nurse Demographics.

	Oncology Units	Nononcology Units	*t* =	*p* =
N	155	224		
Bed size**+	4.03	4.32	-1.988	.048
Teaching status**++	2.21	2.05	1.938	.053
Magnet	.49	.49	-.014	.989
Participating response rate	80.50%	81.00%	-0.082	0.935
% female**	94.19%	90.90%	5.455	0.000
% race white**	74.58%	64.82%	3.64	0.000
% mean age**	39.05%	38.06%	2.081	0.038
yrs in practice in US	10.04	9.36	1.834	0.066
yrs on unit	5.98	5.53	1.725	0.085
job plans-remain in same job**	77.28%	73.72%	2.414	0.016
Job plans same hospital new unit**	6.82% (7.5)	11.65% (9.9)	-5.11	.000
Job plans retire**	1.13% (2.6)	.53% (1.9)	2.573	.010
Nrsg BS degree	55.27%	54.06%	0.671	0.503
Certification awarded by national nursing association**	25.23%	63.99%	-12.676	0.000

** = significance $p \leq .05$

+ Bed size: 1= <100; 2 = 100–199, 3 = 200–299, 4 = 300-–399, 5 = 400–499, 6 = ≥500

++ Teaching status: 1 = academic medical center; 2 = teaching, 3 = nonteaching female ($t = 5.45$, $p < .001$), White ($t = 3.64$, $p < .001$), older ($t = 2.081$, $p < .001$), and more likely to stay in their position ($t = 2.414$, $p = .016$), less likely to change units ($t = -5.11$, $p < .001$), more likely to retire in the next year ($t = 2.573$, $p = .010$) but less likely to work full time ($t = -2.00$, $p = .046$) than their nononcology counter parts. The percentage of nurses certified by a national nursing association was significantly less on oncology units (mean 25.23%) than on nononcology units (mean = 64%; $t = 12.67$, $p < .001$). No significant differences were noted between the groups for teaching or Magnet status. Only bed size demonstrated a significant difference ($t = -1.98$, $p = 0.04$), with nononcology units coming from larger hospitals.

There are no significant differences between oncology and nononcology units on the PES-NWI scores (Table 4.4). All units were generally rated positive with a mean total score of 2.95 on oncology units and 2.94 on nononcology. Nurses in both groups rated the quality of care subscale highest at 3.14 and staffing and resource adequacy lowest at 2.60 in oncology and 2.63 on nononcology units.

Magnet Status

In this sample, almost 50% of each unit type was from a Magnet hospital. Only 7% of all hospitals nationwide have received the Magnet award. This observation resulted in further analysis of the impact of Magnet status on the PES-NWI. When all oncology units and nononcology units were tested together, units from Magnet hospitals had significantly higher scores ($p \leq .001$) on all scales except nurse manager ability, leadership, and support (Table 4.5). This difference is far greater than the differences noted by unit type. The exact same pattern was repeated when nononcology specialty units were tested, with only the nurse manager scale failing to reach significance (see

Table 4.4. Oncology and Nononcology Units PES-NWI.

Mean score:	Oncology Units	Nononcology Units	*t* =	*p* =
Involvement in hospital affairs	2.92 (.262)	2.91 (.279)	0.258	0.796
Nursing foundations for quality of care	3.14 (.206)	3.14 (.205)	0.103	0.918
Nurse manager ability, leadership and support	3.02 (.326)	3.01 (.338)	0.199	0.842
Staffing and resource adequacy	2.60 (.372)	2.63 (.366)	-0.675	0.500
Collegial nurse-physician relationships	3.04 (.236)	3.00 (.243)	1.359	0.175
Total score	2.95 (.247)	2.94 (.253)	0.189	0.850

Table 4.5. Magnet Status: All Units.

Mean score (SD)	Non-Magnet Units	Magnet Units	*t* =	*p* =
N	193	186		
Involvement in hospital affairs	2.84 (.246)	2.99 (.278)	-5.522	.000
Nursing foundations for quality of care	3.10 (.185)	3.19 (.214)	-4.591	.000
Nurse manager ability, leadership and support	3.00 (.308)	3.03 (.358)	-.811	.418
Staffing and resource adequacy	2.56 (.332)	2.68 (.393)	-3.369	.001
Collegial nurse-physician relationships	2.97 (.237)	3.07 (.236)	-3.838	.000
Total score	2.89 (.223)	2.99 (.267)	-3.881	.000

Table 4.6). Oncology unit practice environments were slightly less impacted by Magnet status, with only three scales: involvement with hospital affairs (t = -2.877, p =.005), foundations for quality of care (t = -2.006, p =.047), and collegial nurse-physician relations (t = -2.009, p =.048) reaching significance (Table 4.7).

Discussion

Oncology units are remarkably similar to other specialized noncritical care units in hospitals. The PES-NWI scores demonstrated no significant differences between the two types of oncology units or when oncology units were compared to nononcology units. Scores reported here demonstrated consistency with scores for medical, surgical, and medical surgical units reported by Choi and Boyle (2014). The consistency of results lends support to the application of nurse practice environment research from general adult medical-surgical units to oncology units. It also raises questions about how much variability in nurse practice environments could make a difference to patient outcomes. The differences between mean scores in this and other research with the PES-NWI demonstrate differences of as small as 1/1,000 of a point.

Previous research has converted scores on the subscales into categories describing the environment as favorable, mixed, or poor (Aiken et al., 2008; Aiken et al., 2011; Friese, Lake, Aiken, Silber, & Sochalski, 2008; NQF, 2012). If scores on four or five subscales are greater than 2.5, a unit is favorable. If the score only exceeds 2.5 on two or three subscales, it is mixed, and if only one scale score equals 2.5 or higher, the unit is considered a poor environment. In these data, all unit types were favorable with no mean scores falling below 2.5. Although Choi and Boyle (2014) did not report the subscale of involvement with hospital affairs, they likewise did not report any unit types with a score

Table 4.6. Magnet Status: Nononcology Units.

Mean score (SD)	Non-Magnet Units	Magnet Units	$t =$	$p =$
N	114	110		
Involvement in hospital affairs	2.83 (.257)	3.00 (.277)	-4.759	.000
Nursing foundations for quality of care	3.09 (.186)	3.20 (.208)	-4.327	.000
Nurse manager ability, leadership and support	2.99 (.318)	3.03 (.358)	-.871	.385
Staffing and resource adequacy	2.55 (.334)	2.72 (.379)	-3.471	.001
Collegial nurse-physician relationships	2.95 (.232)	3.06 (.215)	-3.319	.001
Total score	2.88 (.232)	3.00 (.260)	-3.615	.000

Table 4.7. Magnet Status: Oncology Units.

Mean score (SD)	Non-magnet Units	Magnet Units	t =	p=
N	79	76		
Involvement in hospital affairs	2.86 (.231)	2.98 (.280)	-2.877	.005
Nursing foundations for quality of care	3.11 (.183)	3.18 (.224)	-2.006	.047
Nurse manager ability, leadership and support	3.01 (.295)	3.02 (.358)	-.209	.835
Staffing and resource adequacy	2.57 (.330)	2.64 (.411)	-1.134	.259
Collegial nurse-physician relationships	3.00 (.201)	3.08 (2.65)	-2.009	.046
Total score	2.91 (.209)	2.98 (2.79)	-1.706	.090

below 2.5. This clustering of scores in the favorable range again supports the need to understand how much variability makes a difference to outcomes. The use of these categories in past research did provide a method for separating units not found here, suggesting that either nurse practice environments have improved over time or that this sample is significantly different than previous ones.

Beyond the nurse practice environment, there are several notable differences in the nurse workforce between oncology and nononcology units. Diversity differences suggest oncology units are not keeping up with recruitment of men and other minorities in nursing. Nononcology units employ a workforce with 35% non-White nurses, while oncology units lag behind at only 25%. Since bed size is the only hospital level difference noted between the unit types, the cause of these workforce differences are unclear and deserving of further examination. Although not yet examined as a nurse characteristic connected to patient outcomes, a diverse nurse workforce paralleling the patient population is a desirable goal for all practice environments.

The lag in national certification on oncology units compared to other specialties was surprising. This disparity is concerning and deserving of further investigation to understand the attitudes of oncology nurses and nurse leaders regarding certification and why the rates are so much lower on these units. The impact and implications of this difference are unclear and deserving of consideration by oncology nurse leaders. Nurse education is consistent with national trends but lagging behind the national goal of 80% of nurses with a BSN by 2020 (Health Resources Services Administration [HRSA], 2010). Unit longevity and intent to stay on oncology units are encouraging and offer a potential advantage over other unit types for workforce stability, but may also be part of the lack of diversity. It is also important to note that although statistically more likely to stay on the same unit for the coming year, oncology units still stand to lose 23% of their nurses. For oncology nurses, the intention to move out of the hospital to another direct care position was the most common option (9.21%). Compared to nurses from nononcology units, oncology nurses are far less likely to move to a different unit in the same hospital. Future research to understand this movement may present oncology nurse leaders with innovation options for nurses to work across settings and reduce turnover.

The alignment noted between these results and earlier data provides evidence that oncology units are not significantly different than other unit types. This conclusion reduces the need to separate oncology units from other specialties when examining the relationship between the nurse practice environment and patient outcomes. Future analysis should focus on identifying methods to broaden the sample and describe changes over time. The noted differences in the oncology workforce compared to nononcology nurses highlight opportunities for workforce development, but the lack of connection to PES-NWI scores suggests these differences are unlikely to cause significant changes in the practice environment.

Limitations

The impact of Magnet status on the nurse practice environment must be carefully considered. The award is granted in large part based on high quality outcomes, including nurse satisfaction. The PES-NWI is the preferred tool for Magnet award applicants to utilize to measure nurse satisfaction. Demonstration of improvement and generally high unit scores is a minimum application requirement. Nationally, only 7% of all U.S. hospitals have achieved Magnet status, but 21% of NDNQI® members are awardees. As a result, it is not surprising that the sample is overrepresented with Magnet hospitals and that this over sampling will push scores up. The PES-NWI scores for both oncology and nononcology units in this study are consistent with the scores reported for 11 different unit types identified in a recent study also drawn from the NDNQI® database with data from 2011 (Choi & Boyle, 2014). This alignment lends support to the primary conclusion that the practice environment of oncology units is not significantly different than nononcology units. In both studies, Magnet status had a significant, positive relationship to the PES-NWI scores. When PES-NWI scores were compared based solely on Magnet status, the finding that Magnet status makes a significant difference in nurses' perception of their work environment is consistent with previous research and limits generalizability of these data (Stimpfel, Rosen, McHugh, 2014).

In addition to the generalizability limitations of these data due to both the over sampling of Magnet hospitals and the small sample size, the voluntary nature of the NDNQI® database may be the most important barrier to applicability. Composed entirely of hospitals that choose to be members and the further subset of member hospitals that opt to utilize the PES-NWI, data from this sample may not fairly represent all oncology units. Membership in NDNQI® requires both fiscal and human resources. Hospitals are demonstrating a commitment to nurse-driven quality by becoming members, and the full impact of this commitment is not established. No data exist to compare member hospitals to nonmember hospitals directly on any outcomes captured in the database. These data offer oncology leaders a comparison point if they have access to administer the PES-NWI survey even without NDNQI® membership, and it supports the ability to apply other research using the PES-NWI results from the database to oncology units.

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CHAPTER 5

RESEARCH SUMMARY

Introduction

Late stage hospital acquired pressure ulcers (HAPU) were among the first adverse events that the Centers for Medicare and Medicaid determined to be preventable, and as a result, ceased payment to hospitals for the care needed to heal them. This step was taken after several years of research documenting HAPUs prevalence up to 38% in hospitals (Lyder & Ayelle, 2008). As a subset within hospitals, oncology patients compose 17% of all admissions, stay almost 2 days longer than the average, and utilize an average of $6,000 more per stay (Price, Stranges, & Elixhauser, 2012). By definition, HAPUs are an adverse event of hospitalization, placing all patients at risk, particularly those with longer and more frequent admissions like those with cancer. Numerous physiological characteristics with known relationships to ulcer development are also common in people with cancer including advanced age, low body mass index, multiple comorbities, general debility, hypoalbuminia, anemia, and low lymphocyte counts (Alderden, Whitney, Taylor, & Zaratkiewicz, 2011; Bry, Buescher, & Sandrick, 2012). International research has repeatedly focused on HAPUs in oncology and demonstrated higher risk and prevalence in cancer patients than others (Kim, Kim, & Lee, 2010; Maide et al., 2009; Masaki, Riko, Seji, Shuhei, & Aya, 2007), but no comparable data for the U.S. were available. HAPUs have been considered a nurse-sensitive outcome since the writings of Florence Nightingale, who declared bedsores the fault of the nursing field repeatedly in *Notes on Nursing* (1859). As the National Database of Nursing Quality Indicators (NDNQI®) started collecting data on nurse sensitive outcomes, HAPUs were one of the first measures to be included for widespread data collection. Research with a variety of nursing sensitive outcomes has demonstrated a repeated positive relationship between nurse education and nurse practice environment (Aiken et al., 2008; Aiken et al., 2011; Bosch et al., 2011; Choi, Bergquist-Beringer, & Staggs, 2013; Flynn et al., 2010; Friese et al., 2008; Houser et al., 2012). However, numerous gaps in nurse-sensitive outcomes research exist. Little work has been done directly with HAPUs and either nurse variable: education or practice environment. Oncology patients are rarely used as a specific sample in nurse-sensitive research. Overall, the literature is limited by the lack of a unifying model or theory to explain and predict how nurses impact patients (Kane, Shamylin, Mueller, Duval, & Wilt, 2007; Mark & Harless, 2010; Mark, Hughes, & Jones, 2004). Collectively, there are numerous gaps in the knowledge of how oncology patients are affected by nurses and nurse sensitive patient outcomes. This research addressed several gaps, HAPU rates in oncology, risk for HAPUs in oncology, and measuring nurse variables in oncology. Ultimately, a model was proposed, the Nursing Process Model, as a framework for understanding the relationship between nurse variables and patient outcomes.

The Nursing Process Model proposes that the core relationship of nursing sensitive patient outcomes is between a patient's condition and their outcome. The nurse assesses the condition and determines interventions to support the desired outcome. The interventions act to mediate the pathway between patient condition and outcome. The ability of the nurse to assess and identify interventions is moderated by their education and the practice environment. In this case, the patient condition is the risk for a HAPU, measured by the Braden Scale; the outcome is the development or avoidance of a HAPU. Interventions to reduce risk for HAPU are well known and included in NDNQI® data. Nurse education and practice environment measures are captured by use of the Practice Environment Scale of the Nursing Work Index (PES-NWI). The model sought to test the relationships in an effort to improve understanding of the nurse-patient relationship.

This research had several aims. The first was to assess the risk for and prevalence of HAPUs on oncology units and compare both to nononcology specialty units. Using unit level means, risk for HAPU on admission to oncology units was 18.95 using the Braden Scale. Braden Scale scores of 18 and less are considered at risk. This unit mean was not significantly different from the unit mean of 18.62 on nononcology specialty units. HAPU prevalence did not demonstrate any significant differences between units. The HAPU rate on oncology units for all stage ulcers is 2.71% and 3.06% on nononcology units. The second aim was to examine oncology unit nurses' education and practice environment and compare them to nononcology specialty units. No significant differences ($p \geq .05$) were found on these variables. Oncology unit means rate for nurses with a BSN was 57.21% and 52.51% on nononcology units. Total PES-NWI scores were 2.96 and 2.92 for oncology and nononcology units, respectively. The final aim, to test the Nursing Process Model within the oncology units, failed to demonstrate the relationship proposed in the model and will be discussed further.

Sample

The sample was composed of 1,187 units from 392 different member hospitals. Hospitals were spread across all bed size groupings, with slightly fewer units from hospitals with less than 100 beds (7.6%). Units came from teaching (53%) and nonteaching (47%) facilities, and 44% of units were from hospitals recognized by the ANA for nursing excellence with the Magnet award. In comparison, the American Hospital Association (AHA, 2012) reported that only 20% (1,038) of U.S. hospitals are teaching hospitals, and only 7% of hospitals have been given the Magnet award (ANCC, 2014). Of the 1,187 units, 28.6% (340) identified a specialty: 82 were medical oncology and 59 were medical surgical oncology, for a total of 141 oncology units. Another 199 units identified a nononcology specialty, and 847 failed to identify a specialty unit. Throughout the study, medical oncology and medical surgical oncology units were first examined separately and subsequently compared. Units demonstrated minor differences in demographics, but no significant differences were found on any of the test variables. The two were then merged as oncology units and compared to the nononcology unit group.

Summary of Results

HAPU Prevalence and Risk

The first aim of the study was to measure the prevalence of and risk for HAPUs on oncology units and compare it to other units. Study data included quarters 2–4 from 2012. Quarter 1 was not included due to the requirement to match the quarter of ulcer data to the time the PES-NWI was administered. The PES-NWI is not available in the first quarter. Analysis of the full data set was completed first and then each quarter separately. No differences were noted in significance, and all trends remained stable with each sample. Detailed results for HAPU risk and prevalence in the second quarter are presented in Chapters 2 and 3.

HAPUs are defined as a pressure ulcer not documented as present on the admission but present on the day of data collection. HAPU prevalence across the oncology units was 2.14% for all stage ulcers combined. Stage 2 ulcers were most common with a mean unit prevalence of .91% and no Stage 4 ulcers developed. As a subset of HAPUs, unit acquired pressure ulcers (UAPU) are also counted in the database. These are ulcers present on the day the data were collected, with clinical documentation demonstrated, started on the same unit the patient was on at that time. This category is designed to acknowledge patient movement between hospital units and is most closely reflective of care on a specific unit. Overall prevalence for UAPUs on oncology units was 1.78%. Stage 1 ulcers were most common at .7%, followed closely by Stage 2 ulcers (.63%).

As a comparison, units considered adult medical-surgical level of care with a specialty designation were analyzed. Intensive care, pediatric, maternity, emergency, psychiatric, and rehabilitation units were excluded from the sample. Other medical surgical specialty units include neurology, infectious disease, GI, respiratory, cardiac, renal, neuro/neurosurgery, or med-surg cardiac. To compare oncology units to other unit types and ensure stability of the results, three alternative unit groups were identified: all nononcology specialty units, all units without a specialty designation, and then all units were combined at the hospital level. Mean HAPU and UAPU prevalence was calculated for each. No statistically significant differences (all $p \geq .05$) were found for any grouping, and only oncology and nononcology units are reported.

Prevalence rates also demonstrated no difference between oncology and nononcology unit types (all $p \geq .05$). However, prevalence rates in this study are quite different from previous studies. The equivalent prevalence rates across unit types provide support for the generalizability of HAPU data across nonintensive care adult units. This suggests that hospitalization is a greater factor in the development of pressure ulcers than the many physiological risk factors known to cluster in oncology patients. Physiological risk factors for HAPU including low body mass, hypoalbuminia, advanced illness, and general debility are known to cluster in oncology patients, raising the possibility of increased risk. The lack of difference between oncology units and nononcology units points to the hospitalization as the primary concern.

National conditions surrounding HAPU care and prevention must be considered when evaluating these results. Data sources used to plan and prepare this research relied upon data collected prior to 2008. A prevalence rate for all stage HAPUs in all unit types of 4.5% was found in several national studies and represented the largest available published samples (Lyder et al., 2012; VanGlider, Lachenbruch, Harrison, Davis, & Meyer, 2013). Compared to 2.85% on oncology units and 2.64% for nononcology units, data from this study show a notable decrease in prevalence and point to the need for further discussion. National factors need to be considered when comparing these data. As of October 1, 2008, CMS stopped paying hospitals for the care provided to manage a late stage (Stage 3 or 4) HAPU. Calling HAPUs the most common preventable complication of hospitalization, CMS ceased payments to hospitals who allowed them to develop. This policy pushed hospitals to improve the entire process of avoiding HAPUs. Particular emphasis was placed on separating HAPUs from those the patient had on admission. The goal of the CMS policy was to reduce HAPUs; it said nothing about all pressure ulcers. Care and treatment of ulcers that existed prior to the patient's arrival in the hospital were exempt from the reduction in reimbursement. This component of the policy prompted hospitals to focus resources on the admitting assessment and to document as thoroughly as possible all skin breakdown found at that time (McHugh, Van Dyke, Osei-Anto, & Haque, 2011).

In consideration of this policy and to further probe the difference in HAPU rates in this sample from the literature, an analysis of total pressure ulcers was conducted. The count of total pressure ulcers includes both HAPUs and ulcers present on admission. Total ulcers rates were not significantly different between any of the unit types (oncology units 10.88%; nononcology units 11.15%), but the total ulcer rate is consistent with the 10.8% reported in previous literature (VanGilder et al., 2012). The combination of the reduced HAPU but stable total ulcer rates supports the accuracy of the data. Ideally, the reduced HAPU rates are actually evidence of improved patient care. The stability of the total ulcer rate suggests that improved documentation of ulcers present on admission is the actual change since 2008. Alternatively, there may be unknown factors such as changes in length of stay or changes in location of care over the last few years, some of which may be responsible for the low HAPU rates seen here.

Charting also needs to be considered when comparing total ulcer rates between studies because different data sources include charting by different health care providers. NDNQI® is a nursing database. It examines nurse charting to determine present on admission status. CMS data rely on physician charting of ulcers on admission. The source of documentation to determine ulcer presence on admission in other research is not always clear. The HAPU prevalence rates in this study are consistent with other published studies using NDNQI® data since 2008 (Bergquist-Beringer, 2011; He, Staggs, Bergquist-Beringer, Dunton, 2013). CMS data on HAPU prevalence have not been published, reflecting the change in payment policy leaving the possibility that the HAPU reduction is only within select hospitals. Either way, evidence of the stability of the total ulcer count is critical. It suggests that work done in hospitals is successful at improving components of care. Further analysis is needed to determine if hospital care has actually changed resulting in fewer ulcers or if reducing length of stay and reduced readmissions to hospitals is just moving the patient's location when an ulcer develops, not changing the trajectory of ulcer development.

To measure risk, the Braden Scale assessment tool was used. It generates a score ranging from 6–27. Patients with lower scores are considered at risk for a pressure ulcer with 18 as the cut-off point. Scores are reported at two time points: on admission, defined as within 24 hours of admission to the hospital, and the last recorded score in the patient record at the time of the data collection. Across the full sample, 98.1% of last recorded scores were completed in the 24 hours prior to data collection. At no time point was the mean score at or below the "at risk" cut-off of 18. Standard deviations for mean unit scores at both times were almost identical. The largest standard deviation was on oncology units at admission, 1.06, and the lowest on nononcology units at the last score, .995. This lack of variation in both unit types at both time points again connects to homogeneity across units. In these data, patients on oncology units were assessed to be at less risk for skin breakdown by the Braden Scale than their counterparts on nononcology units, a difference that was lost over time. Unit means were never below 18 at either time, the standard off cut-off point that patients are considered at risk, rendering the statistical difference of limited clinical significance.

Within this entire sample of 6,803 patients regardless of unit type, 71% were not at-risk on admission and did not develop a HAPU, 27% were identified as at-risk on admission but did not develop a HAPU, 13.5% were both at-risk and developed a HAPU, and finally 7.5% were not at-risk but did develop a HAPU. These figures were not significantly different for oncology or nononcology units. Numerous studies report that among patients who develop ulcers, there is a high correlation with an at-risk Braden Score ($p < .0001$; Fromanetin, 2009; Tescher, Branda, Byrne, & Naessens, 2012). This was true in these data as well. What is not included in previous research is an examination of those identified as at-risk that never developed an ulcer or those who developed an ulcer who were not at-risk according to the Braden Scale. Reports including tests of sensitivity for the Braden Scale range as low as 64% (Bergstrom, Demuth, & Braden, 1987). The low percent of patients in these data, with an at-risk score who actually developed a HAPU, suggests an opportunity to improve the sensitivity of HAPU screening tools, a point made in previous analysis of the Braden Scale (Lewicki, Mion, & Secik, 2000). The volume of patients not at risk but still experiencing a HAPU is another point for further investigation. Taken together, it is premature to conclude that there are no disease-specific risk factors for oncology patients related to HAPUs. The combination of steady total prevalence rates, equal HAPU prevalence across unit types despite the many known risk factors for oncology patients beyond what is captured in the Braden Scale, and the high mean Braden Scale scores suggests the need to extend the conversation beyond HAPUs into skin failure. The Braden Scale may have been very helpful to identify within the category of hospital risk, but these findings point to a need to investigate pressure ulcers in oncology, likely at the individual level, regardless of where the patient is instead of at the unit level within the hospital.

Nurse Variables

The second aim of the study was to describe the nurses on oncology units along two key nurse variables: education and practice environment. Consequently, the aim was to compare them to nononcology unit nurses. This analysis is reported in detail in Chapter 4.

Nurse education is one of the oldest and most well-tested variables in nursing sensitive research. Despite the effort, clear and convincing evidence of the impact of nurse education on patient care remains elusive (National Quality Forum, 2006). In recent years, leading policy groups have promoted the BSN as the preferred practice degree, setting a national goal for 80% of all nurses to have a BSN by 2020 (Institute of Medicine, 2010). In this sample, a mean of 55.17% of nurses on oncology units has a BSN and 55.17% on nononcology units.

Nurse practice environment is the second nurse variable included in these data. Measures of the practice environment started from analysis of staffing patterns and have evolved to the current best practice tool, the Practice Environment Scale of the Nurse Work Index (PES-NWI), a tool with five subscales and a total score. The unit scores are reported on a 1-4 scale with scores of 2.5 and greater generally considered positive. Nurses on both types of oncology units, medical oncology and medical surgical oncology, rate their units positively with all mean scores greater than 2.5. Lowest scores were given by both unit types on staffing and resource adequacy, and the highest was on the nursing foundations for quality of care. Medical surgical unit scores were slightly lower on all scales, but none were statistically significant. As previously stated, true overall hospital scores cannot be determined from this sample. Two unit groupings were utilized to compare nursing education and the PES-NWI scores: all nononcology specialty units (detailed in Chapter 4) and all units without a specialty designation. The only statistically significant difference between the oncology units and the units without a specialty was on the Collegial Nurse-Physician Relationship scale. On this scale the oncology unit mean score was 3.04 (sd = .243), and the score for all units without a specialty designation was 2.98 (sd = .239, t = 2.945, p =.003). Although not a significant difference, the nononcology specialty unit mean for the same scale was 3.00 (sd = .229).

Much like the prevalence rates, these data suggest that there are minimal differences between oncology and other specialty unit types demonstrating fairly equivalent unit environments, pushing the investigation of the impact of nurses on patient outcomes back toward hospital level. However, this conclusion is inconsistent with the significant differences found in a larger analysis of unit PES-NWI scores conducted with data only 1 year earlier using multivariate testing. Choi and Boyle (2014) examined 11 unit types with data from NDNQI® with a much larger sample size. Results demonstrated a significant difference between the unit types on the overall score even though all scores were above 2.5. Numerous trends identified in this sample were also seen in the larger study. While both scores in general were positive (> 2.5), the staffing and resources scale was rated the lowest, quality scale scores were generally high, and medical units had better scores on all subscales than medical surgical units. Minimal variation was noted in the scores in both studies as well. In this sample, the largest standard deviations were for the staffing and resource scale, .368 and .354 for oncology and nononcology units. The range between the two was also the largest across the scales. The same clustering of standard deviations occurred in the larger study. The lack of significance between unit types in this study may be an effect of sample size. The least represented unit type of the 11 was neonatal units with 207 units. This sample included only 141 oncology units and 199 nononcology units. This lack of group difference and lack of variability was not anticipated in the design of the Nursing Process Model. As proposed moderators to the relationship between a patient's risk for skin breakdown and the development of an ulcer, variation would be needed to measure any impact.

Results for the Analysis of the Nursing Process Model

The third and final aim of this research was to test a proposed model for nursing-sensitive patient outcomes, the Nursing Process Model. Earlier aims and research questions were steps leading to testing this model. Results for all of the research questions for this aim have not been summarized in other chapters and will be detailed here.

Introduction

The Nursing Process Model is an effort to describe how nurse variables impact patient outcomes by reflecting the simultaneous nature of the many components of the nurse-patient interaction. The model proposes that the primary relationship is between the patient condition, risk for HAPU, and the patient outcome, a HAPU. The nurse action, known as interventions, mediates this relationship, changing the primary pathway between risk and outcome. Nurse variables of education and practice environment are proposed as moderators between the patient risk and use of interventions. As levels of the moderator variables change, the strength or direction of relationship between patient risk and nurse interventions changes. In this case as nurse education and practice environment improved, the risk to intervention relationship was expected to increase, ultimately decreasing HAPU prevalence. The Nursing Process Model is a moderated mediation analysis, and it was used to test the overall relationship between nurse and HAPU development on oncology units and nononcology specialty units.

Methods

Testing was completed using the MODMED macro for SPSS (Hayes, 2007). Multiple variations of the model were tested. Two independent variables were tested, first the Braden Score on admission and the last recorded score. The dependent variable was always all stage unit acquired pressure ulcers (UAPUs) because it is the subset of ulcers most impacted by conditions on the unit. The mediator was a calculated rate for the combined use of the five interventions. The model was proposed to be tested with both nurse education and practice environment as simultaneous moderators. This design could not be tested because the syntax of MODMED for moderated mediation only allows one moderator at a time (Hayes, 2007). As a result, the analysis was completed first with the moderator of nurse education, as measured by the mean percent of nurses with a BSN, as the moderator. The mean total PES-NWI score then replaced the measure of education as the moderator.

Results

A total of four different variations of the model were completed with data from the oncology units and parallel testing completed for the nononcology units. Even with bootstrapping to 5,000 with each test, no support for the model was found at any time (Appendix).

Discussion

The Nursing Process Model was designed to measure the entire system of the nurse-patient interaction. It tried to capture the concept that a nurse impacts the patient outcome by assessing and intervening with individual patient conditions, ultimately utilizing their personal knowledge within a specific practice environment. For this research, the patient's risk for breakdown was measured via nursing assessment utilizing the Braden Scale. Prevention measures were theorized to be implemented as a result of the individual patient assessment with ulcer development or avoidance as the outcome of this system. The use of prevention measures was presumed to vary in relation to patient risk based on the assessment findings. Both the nurse's ability to assess and the choice of interventions were theorized to be influenced by the nurse's knowledge and practice environment. The model was designed to measure the impact of a nurse intervening based on a patient assessment to change the patient outcome. In this work, the model failed to demonstrate any significance. But critically, the variables failed to act in the expected way. No significant differences between groups and minimal variance within groups were measured in the two nurse variables or the outcome variable. This lack of variance rendered the model untestable since the chosen variables failed to actually represent points of difference as the model theorized.

Limitations

Testing of the Nursing Process Model was limited by the use of the MODMED macro, which did not allow for use of dual simultaneous moderators. It is also possible that this testing failed to reach significance because the variables were in the wrong place. This design limited the proposed moderators to the relationship between the patient risk and use of interventions. It is possible that nurse education or practice environment moderates the pathway between interventions and outcomes. If the environment is not supportive, or the nurse lacks the knowledge to understand the interventions, then the initiation of regular turning and repositioning as one of the key interventions may not be continued over time. The impact of inconsistent use of the intervention is not known. From a modeling perspective, the possibility exists and deserves testing.

General Summation

Significant changes in the hospital practice regarding pressure ulcers, motivated by payment changes from CMS, have been in place now for 5 years. The loss of reimbursement for any aspect of care provides concrete motivation for change. The loss of reimbursement for the most serious HAPUs was designed to have the effect of reducing HAPU rates. If this sample is an indicator, the policy is successful as long as the examination of HAPUs stops at prevalence. Deeper inquiry and consideration of the totality of these data bring many more questions to light about the impact of changes at this level. There is evidence of numerous components of the system of care for HAPUs having experienced change in the last few years, not all of which were intended.

Before testing the overall model, the final variable in the model, nursing interventions, was analyzed. The five key interventions to reduce HAPU risk are 1) daily skin assessments, 2) using a pressure reducing surfaces, 3) repositioning, 4) nutritional support, and 5) moisture management. All five were considered independent nursing actions based on individual patient assessments in the design of this research. An investigation of the use of these interventions was not an intended aim of this study. However, it was a necessary step to prepare for testing the model. Within this sample, rates of use of the five interventions were never below 75% (Table 5.1) for any subset of the sample, including patients not at risk for an ulcer according to the Braden Scale suggesting that the pressure ulcer interventions are no longer being implemented based on individual patient risk. With the CMS changes in payment, these interventions would have been amenable to organization wide implementation. In fact, if viewed as a clinical bundle, they could be easily implemented as positive, patient care practices for all hospitalized patients regardless of individual risk for skin breakdown.

The evidence here of widespread use of the five interventions demonstrates a pattern of institutional adoption likely driven by the large costs associated with a single late stage ulcer. This suggests that payment policy changes have successfully motivated hospitals to implement standards of care universally. The success of this policy is evident in the HAPU prevalence rates. However, a true evaluation of the program's success would need to include the cost of providing all the interventions to the vast majority of patients who never would have developed an ulcer as well as the hidden costs of removing the nurse decision making from the individual case. Reduction in HAPU development is an important achievement that undoubtedly improved a great many lives. The issues with the large percent of patients identified as at-risk who do not develop an ulcer cannot truly be related back to the use of interventions if everyone receives the

Table 5.1. Use of HAPU Prevention Interventions.

Mean score (SD)	Oncology Units	Nononcology Units	$t =$	$p =$
Daily Skin Assessment	.99(.06)	.99(.07)	1.42	.16
Pressure Reducing Surfaces	.93(.20)	.92(.22)	.75	.45
Repositioning	.87(.27)	.90(.21)	-1.80	.07
Nutritional Support	.78(.30)	.77(.30)	.21	.84
Moisture Management	.88(.24)	.89(.21)	-.628	.53

interventions. In this sample, only 28.5% of all patients (24.6% of oncology patients) were identified as at risk on admission by the Braden Scale, yet all received numerous risk reduction interventions. Certainly, assessing risk, improving support surfaces, skin assessments, regular repositioning, and attention to nutritional needs are unlikely to have a down side for patients. However, the risk of missing other risk factors, or falsely believing that HAPUs are accounted for and do not need more attention, is a risk that needs to be considered. The risk of hospitals waiting until there is a payment loss to invest in nurse-driven patient safety interventions should be considered as well. Alternatively, the influence of the institution to improve patient outcomes can be considered support for the importance of the influence of the nurse practice environment on patient outcomes.

The implementation of across the board use of the interventions raises specific questions in relation to the Braden Scale. Daily skin assessment is one of the five interventions. The goal is to be attentive to Stage I ulcers and other indicators of change. In these data, 97% of patients had a Braden Score recorded within the 24 hours prior to data collection, aligning with the reported use of a daily skin assessment. The link between the risk for HAPU assessment and daily skin assessment is intriguing since they are not the same. The condition of the actual skin presumably could change must faster than the risk score. In these data, mean Braden Scale scores showed minimal change over time. When this is considered in light of the poor sensitivity of the tool and the use of nurse time to repeatedly complete the Braden Scale, daily use is of questionable value. There may be an overreliance on the tool to identify HAPU risk, that in turn may be reducing the use of independent nursing decision making. This possibility could offer insight into the population of patients not at risk according to the scale but who do develop ulcers.

A full understanding of the use of the interventions is beyond the scope of this work. If the conclusion that the pressure ulcer interventions have been largely adopted at the institutional level is accurate, it is unclear what impact variation in the nurse variables could be expected to exert since the opportunities for independent nurse decision and action would be limited. Overall, the lack of variation on these variables coupled with the lack of difference and variation for the nurse variables are significant reasons this test of the Nursing Process Model failed.

Although the lack of variance in the use of interventions limited the ability to test the Nursing Process Model with these data, the drop in HAPU prevalence rates suggests support for the importance of the environment as a whole. At its core, the model proposes that nursing quality is an effect of the nurse–patient interaction via the nursing process. It was built on the idea that individual nurses make individual assessments of specific patients and implement interventions based on these assessments and that both the assessments and interventions would be influenced by the nurse's education and knowledge. The universal adoption of nursing interventions at the institutional level demonstrates the power of the environment to influence the nurse–patient relationship. This use is highly prescriptive and not in alignment with the study design, which was focused on the impact of individual nurses on individual patients. However, the research and work that led to the development of the now well-used HAPU avoidance plan was the culmination of repeated examination of what worked and is an example of successful adoption on a large scale of evidenced-based practice. It is an indicator of the impact of nurse knowledge when applied in a collective, organized manner. The work environment can be an opportunity to shape collective practice by the adoption of clear processes. This perspective is a radical challenge to the move toward individualized patient care and independent professional nursing practice. It supports more universal practice driven by algorithm and decision support tools. This view may provide different opportunities to support evidence-based practice in a way that acknowledges the realities of the actual workforce. The use of the collective environment to reduce patient risk with the adoption of universal processes may be a strategy to accommodate the struggle with both staffing ratios and nurse education levels so often reported in the literature. Conceptually, the development of best practices are based on small groups of nurses identifying patient care practices to be shared and utilized by large groups of nurses. These data, with the noted reduction in HAPUs, may represent successful adoption of best practices. This perspective would support the overall concepts of Nurse Process Model, but require testing opportunities to be drawn from patient care situations earlier in the cycle of knowledge development than HAPUs.

Applying the model to patient outcomes while determining successful nursing interventions could help to define how and why nurses impact patient outcomes. Moderated mediation is a method used in behavioral research (Preacher & Hayes, 2008; MacKinnon, 2008) but rarely used in nursing. This modeling allows the investigation of how and why variables are connected in dynamic systems. It offers the opportunity to move from identifying that variables are related to defining how they are related. Information of this kind could help to close the gaps left behind after implementing clinical guidelines or speed adoption of guidelines into practice.

The Nursing Process Model is an attempt to take a wider view on nursing sensitive outcomes research. It has the potential to offer nurse leaders a way to organize research into systems of care and develop evidence to shape patterns of nurse–patient interactions. Despite the failure to demonstrate significant results in this first test, the model offers an opportunity to organize inquiry into the how and why nurses' impact patient outcomes. It expands on previous efforts to describe a model of nursing quality by aligning the variables with statistical tests matched to the complexity of the phenomenon under study. Future research and debate should seek opportunities to improve and develop various models of nurse sensitive patient outcomes in order to guide practice changes.

Limitations

As a secondary data analysis of components from the NDNQI® database, there are a number of limitations of the data that need to be considered when evaluating the results. The database is strictly voluntary and based on membership. In 2014, there are over 5,700 hospitals in the U.S. (American Hospital Association, 2014), but only 1,800 are members. Just over 20% of all hospitals are qualified as teaching facilities, but 46% of member hospitals are teaching facilities. Finally, over 21% of the member hospitals are accredited as Magnet hospitals by the American Nurses Credentialing Center (ANCC), but only 396 (ANCC, 2014) U.S. hospitals have achieved that status (7%) nationally. The effect of these differences on the study results cannot be quantified precisely but cannot be overlooked. These differences between all member hospitals and the membership of NDNQI® are a large barrier to the generalizability of any research utilizing the database. This study is further limited by the focus on only units with a specialty designation. Only 29% of the units that reported pressure ulcer data and the PES-NWI in 2012 reported a unit specialty, further restricting generalizability. Most importantly, this sample demonstrated Magnet rates over 50% and was the only variable tested that demonstrated a repeated significance with any of the test variables.

At the database level, the proportion of teaching hospital members compared to the percent across the country is deserving of consideration. Teaching hospitals are both places where new knowledge is developed and where innovation is sought. By design, teaching hospitals are invested in research and the application of evidence. Although the title “teaching hospital” is related to the presence of medical education in the form of medical students and residents, they are rarely, if ever, without students of a variety of professional disciplines, particularly nursing. Teaching facilities are highly likely to adopt evidence-based guidelines due to the interest and motivation of staff members. The investment in knowledge development helps to create an environment where changes in patient care processes and standards are more likely to be accepted as part of normal practice. Although these characteristics are not universal, when compared to nonteaching facilities, adoption of changes in patient care practice are likely executed more readily in teaching facilities. This general observation is supported by the Magnet award for nursing excellence.

Applicants for the Magnet award must demonstrate that the hospital fulfills the expectations of the Magnet award criteria. Two of the criteria are empirical quality results and new knowledge, innovation, and improvement. Although NDNQI® membership is not a requirement of Magnet awardees, NDNQI® identifies 407 members in 2013 that hold the award and the April 2014 Magnet count on the ANCC website reported 401 total Magnet hospitals, including 6 outside the U.S. It is reasonable to assume a large, if not complete overlap, of Magnet awardees and NDNQI® membership. There is likewise no way to know exactly how many Magnet hospitals are also teaching hospitals while keeping the data deidentified. If almost half of NDNQI® member hospitals are teaching facilities, then a notable percentage of them must also be Magnet awardees. Either category suggests a practice environment where nursing departments and individual nurses are engaged in quality improvement work, the use and investigation of new knowledge, as well as reporting and using data. These environments are likely to be very different from the other 80% of U.S. hospitals that are not teaching facilities or the 93% that are not Magnet awardees.

Magnet hospitals are also linked by the requirements that awardees regularly use a nursing staff survey and show improvement over time. Although the PES-NWI is not specifically required in the application for magnet, it is the premier tool to meet several application requirements as well as the tool endorsed by the NQF. This is both a motivator for those hospitals interested in applying for the award to join NDNQI® but also a reason why the PES-NWI results are generally positive and a possible explanation for the lack of variation. Without an opportunity to survey nurses in nonmember hospitals, it is impossible to quantify the self-selection bias.

The NDNQI® database is a critical tool for research about nursing sensitive patient outcomes. The Collaborative Alliance for Nursing Outcomes (CalNoc) is a similar database but only serves nine states, and the Military Nursing Outcomes Database is limited to military hospitals and researchers. NDNQI® is by far the largest database in both membership and collected data. However, the self-selected hospitals contributing data create a skewed picture of hospital care in the U.S. The similar profile of the member hospitals raises questions about the applicability of the data to the general hospital population and may explain the limited variation found in numerous variables in this study. The implications for the use of research findings and future research are significant.

In this research, the prevalence findings for unit-acquired pressure ulcers in oncology may be artificially low as an effect of the oversampling of teaching and Magnet hospitals. Without any measureable evidence to define these environments in relation to nonteaching and/or non-Magnet hospitals, concluding that HAPUs in U.S. oncology units are different then the international literature presents is premature. Additionally, the finding that HAPU prevalence in all unit types has dropped by almost half since 2008, although supported by other analysis of NDNQI® data, cannot be extrapolated beyond the member hospitals of NDNQI®.

The issue of documentation is another limitation that cannot be fully measured. The pressure ulcer data are collected primarily from nursing documentation in the patient chart. This poses two levels of potential error: first with the original charting and then with the collection and recording of data. The collection of the data and reporting into the NDNQI® database are done by protocol by hospital nurses trained by NDNQI® in accordance with detailed processes. It has been tested for reliability and validity (Hart, Berquist, Gajewski, & Dunton, 2006). It is an unlikely source of systemic error, but it cannot be ruled out. Any form of data capture that cannot be independently verified must be considered a potential source for error. The original charting is a less reliable point in the process. Even though nursing charting is a cornerstone of patient care and is the only true method to track, understand, or recall care activities and patient conditions, it is only as reliable as the person recording it. The dramatic shift in prevalence rates for HAPUs introduces the possibility that poor nursing charting historically was part of the HAPU problem. It is possible that the real reason HAPU rates have declined is an improvement in charting practices. This possibility alone is ample evidence to consider charting as at least potentially unreliable.

These data did not include any information about reason for admission, length of stay, readmissions, or general morbidity, which are all notable gaps for understanding the physiology of pressure ulcer development. Research into patient outcomes at the unit level is still rare, and access to this type of information is limited. Without this level of patient specific information, conclusions need to be drawn only to the hospital unit and not to the patient. Even the use of the unit designation is a potentially limiting factor of these data. NDNQI® protocol allows the use of a unit specialty if 80% of patients cared for on the unit meet the diagnosis. This is challenging because the use of a specialty designation in the database is optional, creating large numbers of units known only as medical surgical and because even when a specialty is identified. It is still only a proxy measure for the patient. Any conclusions about the link between HAPUs and cancer as a patient diagnosis are limited by the use of the unit instead of actual diagnoses.

Recommendations for Future Research

This study has identified four key areas for future research each with numerous specific opportunities: 1) the effect of the Magnet award, 2) skin failure instead of HAPUs, 3) oncology patient-specific nurse-sensitive research, and 4) the link between hospital and unit level nurse variables. The lack of variability in each variable of this research could be the result of the source of data. As the primary database used by Magnet-awarded and Magnet-seeking hospitals, the vast majority of hospitals in the U.S. are underrepresented. The effect of Magnet hospital status may be the key driver to hospital quality both for patients and nurses. More research with non-Magnet hospitals is needed. This research needs to further separate out organizations working to achieve Magnet status from those who are not, as this may represent a three-stage process with distinct implications for patient outcomes. A particular challenge to achieve these comparisons is the lack of data from hospitals who are not members of NDNQI®. NDNQI® offers the largest source for nurse-driven data and will likely continue to be so for the foreseeable future. But if the trends identified here continue, the member driven model will need to be challenged. A deeper understanding of what is happening in non-Magnet, nonmember hospitals, which are the vast majority of hospitals, needs to be a greater focus to reduce the risk of overgeneralizing results. In this case, the low HAPU prevalence rates are aligned with other reports from NDNQI® hospitals but in stark contrast to reports of different samples. This gap needs to be examined in future work.

The second area for future research is to explore the differences between HAPUs and skin failure. HAPUs were identified as a hospital adverse event and as such received large amounts of attention and research. These data suggest that HAPU development has been reduced by almost half in less than 5 years. But the prevalence of skin breakdown has not been reduced. Any number of system changes may account for the reduction in HAPUs. It is time for research to broaden the scope to skin failure without regard to where the patient is when it starts. This work needs to consider all locations of patient care and probe multiple factors related to skin breakdown. An underutilized data point in the NDNQI® pressure ulcer database is a single question the nurse collecting data answers about whether the patient was considered at risk for skin breakdown due to the score on the risk scale or other clinical factors. This question was not included as a variable of interest in this analysis and is not well suited to unit-level data analysis. It is an underutilized aspect of the database. No published studies could be found focusing on this question. Since it is designed to capture nursing decision making beyond the Braden Scale, it may offer a critical link to understanding skin failure as a physiologic process, not an adverse event. This question may be the bridge to articulating the next level of nursing knowledge regarding ulcer development.

The third direction for future research is the need for oncology specific nurse-sensitive outcomes research. This study used units as a proxy measure, but knowledge about HAPU risk and prevalence in oncology needs to expand to actual oncology patients. The proxy measure of units provides a convenience sample but lacks a finite connection to actual patients with cancer. Replicating the analysis in oncology-specific hospitals is one option, but individual patient factors will need to be carefully evaluated as these hospitals care for only 15% of people with cancer and are likely the most complicated cases (National Cancer Institute, 2010). Cancer affects one in two men and one in three women in their lifetime (American Cancer Society, 2013). With total ulcer prevalence rates hovering at just over 10% in multiple samples, large numbers of people with cancer are at risk for an ulcer both as an adverse event of hospitalization and as the outcome of skin failure. Even if the lack of prevalence variance across unit types is replicated in future studies, future work needs to expand to the oncology patient across the continuum of care and to outcomes much broader than just HAPUs. Nurses encounter cancer patients across the continuum of care and in all care settings. The lack of oncology-specific knowledge on common patient outcomes is the first challenge. Identifying oncology-specific nurse-sensitive outcome measures must follow.

Finally, the link between hospital and unit level nurse variables needs attention. These data found no significant difference in the nurse education level and practice environments across unit types. This suggests the hospital overall may have a significant role to play in the factors affecting nurses and nurse characteristics. The possibility that Magnet status is the key driver for all of these variables would support this. Research needs to continue to measure variability across hospitals and within hospitals to identify how each impacts nurses and ultimately patients. This information will help to identify strategies to manage and improve nurse-sensitive patient outcomes by allocating resources and decision making to the appropriate levels. Further work needs to fine tune the point at which nurse education and practice environment scores actually change patient outcomes. The seminal study by Aiken et al., (2003), which concluded that a 10% increase in the proportion of BSN nurses on the unit was associated with a 5% decrease in mortality, was completed at a time when only 29% of nurses had a BSN (Sprately, Johnson, Sochalski, Fritz, & Spencer, 2000). With BSN rates over 50% in this sample, it is unknown if this conclusion still applies. The interactive effect of clinical guidelines with nurse education levels is unknown. This relationship needs continued exploration to best harness nursing knowledge for patient care and identify methods to balance between individualized interventions and population management.

Recommendations for Clinical Practice

These data imply that hospitals have largely adopted the guidelines from the National Pressure Ulcer Advisory Panel (NPUAP-EPUAP, 2009) as a clinical bundle. Although there are numerous other possibilities, it may be this action that has driven the HAPU rates down within NDNQI® member hospitals. This explanation is consistent with the research supporting the development of these guidelines and the use of clinical guidelines in general and should not be dismissed. Hospitals who have not adopted the NPUAP guidelines should take steps to do so to reduce patient risk and HAPU development. These guidelines can also be adapted for nonhospital care environments, particularly for cancer patients. The five interventions could be included as cancer nurses assess patients across the continuum. Oncology nurses in all settings can assess patient risk with the Braden Scale, teach repositioning techniques, identify nutritional needs, and discuss pressure relieving surface options for chairs and beds. Home-based care, including hospice, can work to ensure mattresses have pressure reduction and redistribution qualities directly, all of that would support the shift from HAPUs as a hospital event to skin failure as a patient condition.

Patients would also benefit from non-Magnet hospitals evaluating the Magnet model and measures to adopt as much of it as possible. The cost of applying for the Magnet award may be a barrier for some hospitals, but adoption of the principles, models, and practices of Magnet hospitals is not the same as applying for the award. Nurse leaders can access and utilize much of the knowledge captured in the award process without the added expense of the application. The growing body of knowledge supporting the Magnet model, including this research, is evidence that patient risk is reduced and safety increased within hospitals embracing this model.

Conclusion

Results of this study were not as expected. Oncology units were expected to be measurably different from other units both for HAPU variables and nurse variables, neither of that was found. The overall moderated mediation Nursing Process Model failed to reach significance regardless of unit type, but given the lack of difference and variability across all variables in the model, the model needs further testing before determining its usefulness. HAPU rates in this sample are low and consistent with other published samples from the same database. Rates drawn from other sources need to be determined and compared before concluding that HAPU prevalence has truly decreased in the U.S. These data highlighted limitations of the use of the Braden Scale, the mostly commonly utilized tool to assess risk for skin breakdown due to questions of sensitivity, and reinforced the need to further investigate ulcer development beyond the dimensions measured in this scale. Nurse education and practice environments scores were consistent with other published reports, but again failed to identify any oncology specific differences. As a whole, it could be concluded from this sample that no differences exist in either patients or nurses between oncology and other specialty hospital units, reducing the need to study them separately and increasing the generalizability of hospital level data to different unit types.

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APPENDIX

MODMED RESULTS

Table A.1.

Conditional Indirect Effect at the Mean (2.9) with Moderator = PES-NWI Total.

Unit type	IV	Indirect effect	*SE*	*z*	$p >$ |z|	Lower percentile	Upper percentile
Oncology	Admission Braden Scale score	.0003	.0068	.0438	.9651	-.0134	.0095
	Last Braden Scale score	-.0002	.0078	-.0282	.9775	-.0198	.0087
Nononcology	Admission Braden Scale score	-.0191	.0191	-.9957	.3194	-.0889	.0347
	Last Braden Scale score	.0223	.0226	-.9839	.3252	-.1235	.0308

** bootstrapping = 5,000

Table A.2.

Conditional Indirect Effect at the Mean (55) of the Moderator Nurses with a BSN.

Unit type	IV	Indirect effect	*SE*	*z*	$p >$ |z|	Lower percentile	Upper percentile
Oncology	Admission Braden Scale score	.0000	.0071	.0044	.9965	-.0166	.0114
	Last Braden Scale score	-.0007	.0079	-.0916	.9270	-.0225	.0082
Nononcology	Admission Braden Scale score	-.0220	.0204	-1.0778	.2811	-.0905	.0353
	Last Braden Scale score	-.0269	.0245	-1.0975	.2724	-.1328	.0314